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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

Centenary of the First Canadian Railway

AMONG the many points of interest in connection with the centenary of the Champlain & St. Lawrence Railroad—the first public railway in Canada—is the fact that it was probably the earliest line in the world to have been planned as a link in a chain of international communication. As with many of the early railways in the U.S.A., the title indicated that the line was intended to join two navigable waterways; the actual terminal points were Laprairie on the St. Lawrence River and St. John's on the Richelieu River which leads into Lake Champlain. Three ferries were operated across the St. Lawrence River in that early period—between Montreal and St. Lambert; between Montreal and Longueuil; and between Lachine and Caughnawaga. In winter all transport was by sleigh over the ice. The railway company secured powers to run its own ferry direct from Montreal to Laprairie, and, with the opening of the railway on July 21, 1836, Canadian traffic for the U.S.A., both passenger and freight, was conveyed from Montreal by the new ferry across the St. Lawrence River to Laprairie, then by rail to St. John's, and thence by water across the international border to Lake Champlain and, via the Hudson River, to New York. In 1842 Charles Dickens travelled from Montreal to New York by this route, and, although he said little of the railway, commented favourably on the appointments of the connecting Champlain Transportation Company's steamer *Burlington* from St. John's southward. In a news article on page 155 we refer to the centenary celebrations of this pioneer line, held last week-end.

* * * *

The Railway Wages Hearing

The Railway Staff National Tribunal, which has been considering the wages claims of the National Union of Railwaymen and the Railway Clerks' Association, concluded the public hearing on Monday last, July 20. Thus the proceedings in public lasted only three-and-a-half days. The proceedings before the Railway National Wages Board in the early months of 1931 (which led to the issue of Decision No. 119, and which afforded to the companies the relief which is the subject of dispute in the present case) occupied thirteen days and, as may have been expected, there have been other differences between the two sets of proceedings; these are due doubtless, at any rate in part, to the different composition of the respective bodies. The proceedings which have just terminated have been complicated and the Chairman, at the termination, intimated that it must be expected that the tribunal would take some little time to arrive at its decision. Meanwhile, the publication of the decision is awaited with keen interest by the railway companies, by the railway trade unions, by the employees, by the stockholders, and by the public.

* * * *

The Week's Traffics

For the 29th week of the current year the merchandise traffics of the three heavy lines show a satisfactory improvement on top of good takes for the corresponding week in 1935, but the substantial advances in coal go against moderate decreases a year ago. The passenger train increases of the L.M.S.R. and L.N.E.R. are much greater than those for the corresponding week in 1935, when the Southern recorded a gain of £24,000. In the 29 weeks of the present year the four companies together have estimated gross earnings of £83,565,000, an increase of £2,289,000, or 2·82 per cent., compared with an increase of 2·61 per cent. at the end of the previous week.

	29th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 64,000	+ 47,000	+ 48,000	+ 159,000	+ 1,213,000	+ 3·69
L.N.E.R. ..	+ 21,000	+ 23,000	+ 34,000	+ 78,000	+ 692,000	+ 2·88
G.W.R. ..	—	+ 6,000	+ 5,000	+ 11,000	+ 276,000	+ 2·03
S.R. ..	— 1,000	+ 500	+ 1,500	+ 1,000	+ 108,000	+ 1·00

London Transport receipts for the past week are £9,200 up, making an increase of £27,400 for the three weeks of the new financial year.

* * * *

Three Months' Passenger Train Traffics

A noticeable feature in the Ministry of Transport analysis of passenger train traffics of British standard gauge railways (excluding London Transport) for the first three months of 1936, is the increase of 628,936, or 3·16 per cent., in the number of standard fare passengers, and of £43,663, or 3·37 per cent., in standard fare receipts. Another matter worth attention is the advance in first class, apart from season tickets, both in numbers and receipts, and it may be taken for granted that the advance is mainly due to the latest reduction in fares. For the first quarter of 1936 first class passengers numbered 3,438,407, an increase of 454,569, or 15·23 per cent., in comparison with the first quarter of 1935, and they represented 1·79 per cent. of the total number travelling. First class receipts for the quarter amounted to £792,846, an

increase of £94,821, or 13·58 per cent., and represented 9·55 per cent. of the total ordinary passenger receipts. Day, half day, and evening excursion passengers (all classes) increased by 3,808,968, or 4·19 per cent., and brought in £114,174, or 4·46 per cent., more. In monthly return and period excursion passengers there was an increase of 549,843, or 8·25 per cent., and the receipts therefrom advanced by £167,824, or 7·42 per cent. Standard fare receipts for the quarter, amounting to £1,341,128, represented 16·15 per cent. of the total receipts from ordinary passengers. Season ticket receipts improved by £26,795, or 1·24 per cent., and parcels and miscellaneous traffic brought in £7,093, or 0·24 per cent., more.

* * * *

Standard and Exceptional Charges Review

At the close of the inquiry on June 19 last into the standard and exceptional charges of the four group companies the Railway Rates Tribunal intimated briefly that no general modification of those charges need be made. The formal judgment embodying this decision has now been published. It is the view of the tribunal that the expenditure of 1936 is likely to rise above the level of 1935 and offset to a very large extent the increase in gross receipts. There is a tendency for the prices of materials generally to rise, while coal under new contracts will cost the railway companies 1s. a ton more and so add to expenditure under that head alone some £300,000 in the second half of the current year. The wages and salaries bill is also likely to be greater. Apart from variations between 1935 and 1936 in the amounts charged for rates and contributions to the Railway Freight Rebates Fund, the net revenue of each of the companies for the current year may, in the judgment of the tribunal, be expected to be greater, but not to any material extent, than it was for 1935. In the five years ended December 31, 1934, about 400,000 new exceptional rates were brought into operation for goods carried by merchandise train. Largely as the result of this the tonnage carried at standard charges has dropped from 23·48 per cent. in 1930 to 16·23 per cent. in 1935 whereas that carried at exceptional rates has increased from 76·52 per cent. to 83·77 per cent.

* * * *

Midi Railway of France

Operating results of the Midi Railway of France for the year 1935 were adversely affected by the same conditions as those influencing the working of the Orleans Railway, which were mentioned in THE RAILWAY GAZETTE of April 24 last. Though the two undertakings are worked as one system, each company maintains its separate existence. The report of the Midi Company does not distinguish the items making up the joint receipts and expenses, but gives the separate totals for the Midi system, which compare as follow with those for 1934, when joint working began:—

	1935	1934
	Fr.	Fr.
Gross receipts ..	681,763,049	748,412,091
Expenditure ..	710,364,784	735,984,503
Net receipts ..	Dr. 28,601,735	12,427,588

From the 1935 expenditure there is, however, to be deducted the sum of fr. 16,791,485 representing the *prélèvement* under the Law of July, 1935, which reduces the loss on working to fr. 11,810,250. The final result of the year's operations is that a claim of fr. 363,466,252 has to be made against the Common Fund, compared with fr. 341,573,996 for 1934. The dividend is unchanged at fr. 50, and the length of line in operation remains at 4,290 km. Electric operation was in force at the end of the year on 1,863 km., or 45 per cent. of the whole Midi system, and plans are being prepared for the electrification of the Orleans line between Tours and Bordeaux.

* * * *

Kowloon-Canton Railway (British Section)

The British Section of 22 miles from Kowloon opposite Hong Kong meets at Shum Chun the Chinese Section of 89 miles running thence to Canton. Operating revenue of the British Section during 1935 was affected considerably by the economic instability resulting from the high price of silver, by the complete failure of the fruit crop in Kwang Tung Province, and by the rate war among the Canton river steamers. Through passengers between Kowloon and Canton reached a record in numbers, but receipts therefrom were 12·2 per cent. lower because of reduced fares necessitated by steamboat competition. Terminal through goods traffic increased both in tonnage and receipts.

	1935	1934
Passenger journeys	2,799,352	2,683,444
Paying goods, tons	101,534	81,130
Train-miles	231,716	228,987
Operating ratio, per cent. ..	64·53	57·52
	$	$
Gross receipts	1,411,674	1,639,775
Operating expenses	911,020	943,171
Net operating revenue	500,654	696,604
Net surplus	405,211	105,053

The rationing of monthly expenditure throughout the year, on a one-twelfth budget basis, has enabled savings to be made generally. Train mileage per engine hour has been increased from 8·71 to 9·65, and the running costs per steam train mile have been reduced 10 per cent.

* * * *

Avoiding Crewe

Few important railway junctions in Great Britain, probably, are more completely equipped with avoiding lines than Crewe, on the L.M.S.R., and in view of the heavy traffic from six different directions which is dealt with at this busy centre—rising to a peak of 510 trains on a Saturday at the height of the summer season—it is perhaps surprising that the decision now reached to use the avoiding lines for passenger trains, when necessary to avoid congestion in the station, has not been reached earlier. We believe that there have been periods when passenger trains have burrowed through the tunnels to avoid the station, but for years past their use has been confined to freight traffic. Appropriate signalling measures have now been taken, however, to regularise these avoiding routes for passenger working, and the relief to the station at busy times should be considerable. Every one of the six lines converging on the station—from London and Birmingham, Stoke-on-Trent, and Shrewsbury in the south; and Holyhead, Carlisle and Liverpool, and Manchester in the north—has direct access to the avoiding line tunnels, and all routes thus stand to benefit equally. Other signalling improvements, to facilitate traffic working, have been carried out on the Crewe-Holyhead main line, where three new signal boxes have been installed, and new platform arrangements at Rhyl will enable the heavy traffic of that popular resort to be handled with more expedition than previously.

* * * *

Design on the Railways—King's Cross Station

Mr. George Dow's letter in last week's issue was an interesting reply to the question raised in our editorial of July 3, namely, what did the public think of our stations at the time they were built? Mr. Dow referred

to his company's King's Cross station, opened in 1852, and quoted contemporary comment on its "magnificent appearance." He rightly looks at this station with approval, and if he will refer to our issue of May 10 of last year he will find that an editorial on "Our Termini" contained these words: "King's Cross disarms criticism by its utter unassertiveness, and, more than all the others, suggests its purpose." The fact that this station pleased critics when it was built, and is still considered to be an excellent example of fitness for purpose, goes to show that simple sincerity is always pleasing, although the penetrating remark of Mr. Norman Bel Geddes should be remembered, wherein he points out the great difference between a design kept simple by a fine, sensitive artist, and one that is only left bare by a less able man. In designing our first stations architects started, literally and metaphorically, with a clean sheet of paper, without any precedent to follow, such as road coaches for railway coaches. In designing King's Cross station Mr. Lewis Cubitt allowed the façade to evolve itself from the necessities it covered, and his labours remain a success. Perhaps another reason is that its functional simplicity is not self-conscious, as is the case with some of our modern stations, whereby they fail, for "simplicity" that flaunts itself is not simplicity but merely a pose.

* * * *

The Barkston Accident

Lieut.-Colonel Woodhouse's report on the collision at Barkston, L.N.E.R., on January 19 will be found summarised on page 156. As we expected, he concludes that the responsibility must be placed on the driver of the leading light engine, and considers he was not paying proper attention to signals, the failure being possibly attributable to trying weather conditions coming near the end of a turn of duty. This driver, his fireman and the driver of the second engine, were brought before the Lincoln Assizes on a charge of manslaughter, as already reported in our columns. The case was heard on June 15 and 16 and the three men were acquitted. The evidence given before Col. Woodhouse was contradictory; no driver can be expected to admit that he passed signals seen to be at danger, in any case, but the evidence of the Peascliffe signalmen appears to us entirely trustworthy and we do not believe that any signals there were off when the light engines passed. Apparatus which would have afforded mechanical certainty on this point was admittedly not provided, nor would it be justified now, seeing that continuous track circuits and light signals are to be installed from Grantham to Barkston, which will result in the abolition of Peascliffe box. Col. Woodhouse's conclusions appear the only possible ones to draw from the available facts. Eight unfortunate men in the ballast train lost their lives, another tragic instance, as we see this case, of the old sad story of taking too much for granted.

* * * *

New Composite Sleeping Cars, L.M.S.R.

About a year ago the L.M.S.R. placed in service the first of a series of new first class sleeping cars, of which we gave detailed descriptions in our issues of August 23 and November 22 last year (pages 305 and 869 respectively). Not only were these cars thoroughly up to date as to internal equipment, but they were notable for their constructional features. The underframe and bogies followed the general standard L.M.S.R. method of construction in being built up from rolled steel sections, but instead of riveting, arc welding was used in their fabrication. Further, the body structure incorporated certain notable new features, which we described at the time, and which added considerably to the strength and rigidity of the whole vehicle, as well as saving weight. On page 146 of this issue will be found pictures of a new series of 13 composite sleeping cars now being built at Derby, the first of which have just been placed in service. These new vehicles are built on the same principles and are of the same overall dimensions as the first class cars, namely 69 ft. by 9 ft. 2¼ in. From our illustrations it will be seen that the internal arrangements incorporate the latest refinements, including Thermotank heating and ventilation. Special attention has been paid to the reduction of noise in running.

* * * *

A New American Streamlined Train

Criticism of railway travel is sometimes founded more upon reminiscence than current experience. Rolling stock, to the non-technical eye, does not change greatly in external appearance, and this apparent similarity without is thought to imply lack of progress within. When steps are taken to impart novelty of outward aspect to a train, however, the public has often shown itself eager to investigate the interior, as has been confirmed by the success of the Silver Jubilee in this country, and of The Hiawatha in America. The New York Central has now added a fresh weapon to the combined appeal of unusual colour and contours exemplified in the trains just mentioned. Its new streamlined express The Mercury, which is illustrated on page 150 this week and was briefly described on page 1223 of our issue for June 26, carries concealed floodlights on the Pacific locomotive to illuminate the driving wheels and motion. Inside, The Mercury is designed to appeal less by its novelty (except as a train) than by its approach to the atmosphere of home and club life. Seating is either moveable, or arranged in groups on the lines of an hotel lounge. All cars are air-conditioned. The enticement of a journey behind the first floodlit locomotive leads on to the pleasure of recognising familiar surroundings in an unexpected setting.

* * * *

The Modern 4-4-0 Locomotive

In contrast to most of the brilliant pre-war feats of 4-4-0 engines, which were largely the result of hard flogging and heavy coal consumption, the powerful modern examples of the type are so rarely extended that their maximum capacity is as yet scarcely revealed. The details of working on the Southern Railway Folkestone expresses, published on page 153 of this issue, show a great amount of power in reserve, and, as might be imagined, the "Schools" class three-cylinder engines can successfully handle far heavier trains. We have noted, for example, No. 921 *Shrewsbury* to reach Folkestone in 78 min. net with 420 tons behind the tender, and in the reverse direction we recently timed No. 917 *Ardingly* to cover the 25·6 miles from Smeeth to Paddock Wood at an average speed of 73·2 m.p.h., with 390 tons behind the tender. A striking example of modern 4-4-0 performance was afforded recently by the L.N.E.R. Class D.49 three-cylinder engine No. 249 *Aberdeenshire* on the 6.38 p.m. express from Newcastle to Edinburgh. With no less than 435 tons gross behind the tender, barely two minutes were lost to Berwick on a booking fully 9 minutes harder than that of the Flying Scotsman. Over the 17·8 miles from Christon Bank to Goswick speed averaged 68·1 m.p.h., and in climbing the 1 in 200 grade to Grantshouse 46½ m.p.h. was sustained. Runs such as this are not merely a measure of locomotive capacity but also of competent handling; indeed, some really scientific methods of driving were witnessed by the observer on the footplate in the Southern runs to which we refer.

Railways and the Conveyance of Livestock

THE close association of the railway companies with the livestock industry of this country is indicated by the fact that during 1935 they conveyed more than ten million animals, comprising 5½ million sheep and lambs, 2¾ million cattle and calves, and nearly two million pigs. Speedy, reliable and cheap transport is a feature essential to the successful rearing, fattening and marketing of livestock, as can be understood from the following circumstances. Lambs are chiefly bred and reared in the mountainous districts of Scotland, Northern England and Wales, but as these areas do not provide the extensive feeding grounds required by the sheep as they grow, large numbers are moved early in life to the lowlands of central, southern and eastern England for grazing purposes, after which they are again moved to the large centres of population for consumption. Cattle are largely produced as "store" animals in Wales and Ireland, and are transported to the grasslands of central England and to the Scottish lowlands for feeding in the open, and to eastern England for stall feeding until they are ready for conversion into beef, when they are again moved on to the markets. Scottish cattle, however, are usually produced, fattened and converted into beef locally before marketing, while the movement of live pigs is also somewhat restricted, as they are bred and reared in practically all agricultural districts and generally sold to local bacon factories and markets before again being transported to the consuming centres as bacon or pork.

The transport of such a vast number of animals necessitates the maintenance of large stocks of specially constructed rail vehicles, all of which are designed to minimise the possibility of injury occurring to the stock *en route;* in addition, the four main line companies are continually enlarging and improving their extensive stock of road vehicles equipped for the conveyance of livestock. Live animals are forwarded on express freight trains or passenger trains, as may be necessary, and every endeavour is made to ensure the most expeditious transit possible. Great care is exercised to ensure the comfort and safety of the animals during transit and for this purpose they are inspected by the guard and station staff at frequent intervals during the journey, while the labels on all wagons carrying stock for long distances bear a clear indication of the place and time at which the animals were last fed and watered in order that further supplies may be given them when necessary. Milking cows, in particular, are specially cared for when making lengthy journeys by rail, and arrangements are frequently made for them to be milked *en route* in order to prevent discomfort.

To facilitate loading and unloading, special pens and other accommodation has been provided at a large number of stations, and the whole of this accommodation, together with the vehicles used for the transport of livestock, is most carefully cleansed and regularly disinfected in accordance with the detailed requirements of the Ministry of Agriculture. Outbreaks of foot and mouth and other diseases occasionally occur, and to meet such eventualities the railways maintain a special organisation in close co-operation with the Ministry of Agriculture whereby immediate advices can be despatched at any time of the day or night to all railway staff concerned with the movement of livestock, in order that every effort may be made to localise the disease and minimise its serious effect on trade. In addition to the facilities offered by the companies for the safe and rapid transport of livestock, the insurance and farm removal schemes introduced by the railways in recent years have been of material assistance to the trade, while a further innovation is the attendance of railway representatives at all important agricultural and horse shows, cattle markets, sales and fairs throughout the country for the purpose of giving assistance to farmers and dealers in connection with the despatch of animals.

* * * *

Northern Railway of France

THE adverse conditions which affected earnings in 1934 were even more pronounced in 1935 on the 3,830 km. of this company's lines in France. Similar conditions and a further reduction in transit traffic also militated against the Nord-Belge system—controlled by the Nord—which has lines 170 km. in length serving Liége, Namur, Dinant, and Charleroi. Gross receipts on the French system were lower by fr. 149,023,737, but it was possible to reduce expenses only by fr. 19,188,793. On the working of the two Ceinture lines of Paris, the company had to bear a loss of fr. 4,442,741, compared with fr. 3,949,529 in 1934 and fr. 5,128,299 in 1933. The result of the year's operations on the Nord system in France in 1935 has been that after meeting all outgoings, including capital charges of fr. 577,279,476, there is a deficit requiring a claim of fr. 600,836,543 from the Common Fund, compared with fr. 518,521,712 in 1934. The dividend for 1935 is fr. 70 on each fr. 400 ordinary share, against fr. 85 for 1934 and 1933, and a bonus distribution is also made out of reserves of the property account (*domaine privé*), of 262,500 four per cent. bonds, or at the rate of one bond for each ordinary share. The working of the Nord-Belge lines in 1935 resulted in a deficit of 46,574,033 Belgian francs, against 9,785,601 in 1934. To meet this deficit, which has been aggravated by the devaluation of the Belgian franc, the sum of French fr. 11,077,679 has been withdrawn from the Nord Company's property account. At the time of issue of the report no decision had been given on the company's appeal against the judgment of the Belgian Court of first instance that the Namur-Liége concession expires in 1941 and not in 1953.

The number of passengers carried in 1935 was 6·2 per cent. lower than in 1934, notwithstanding slight increases in Anglo-French traffic and in traffic with Belgium and beyond. So many advances in speed have been made during the past few years that the margin available for acceleration has become slight. Better connections have continued to be made, and the use of railcars has been extended. First class passengers in 1935 brought in 7·37 per cent. and second class 23·16 per cent. of the total passenger receipts, comparing with 7·68 per cent. and 22·76 per cent., respectively, in 1934. The traffic in *colis express* shows even better results than before and the use of containers grows steadily. *Grande vitesse* traffic, however, as a whole was down, and *petite vitesse* tonnage suffered a fall of 7·8 per cent. Figures in the accompanying table refer to operations in France.

	1935	1934
Total train-kilometres	54,631,296	54,662,737
Operating ratio, per cent.	101·75	94·09
Passengers	119,366,362	127,251,987
Petite vitesse, tons	44,378,887	48,158,653
	Francs	Francs
Passenger receipts	392,673,275	407,182,189
Goods and express parcels, G.V.	144,814,812	148,485,570
Goods, P.V.	975,400,545	1,101,746,354
Gross receipts	1,579,757,621	1,728,781,358
Working expenses	1,607,389,039	1,626,577,832
Net receipts	Dr. 27,631,418	102,203,526

To the fr. 27,631,418 loss on working has to be added the ⅓ share (fr. 2,729,248) due to the State Railways from the operation of the Amiens-Rouen line. On the other hand, the *prélèvement* of 10 per cent. under the law of July 16, 1935, amounts to fr. 45,124,332, and gives net receipts of fr. 14,763,666.

South Manchuria Railways in 1935

THE 35th annual general meeting of the South Manchuria Railways Company was held at the Railway Association Hall, Tokyo, June 20. A dividend of 8 per cent. on ordinary stock, and 4·4 per cent. on Japanese Government shares, both unchanged from last year, were declared. A resolution to approve a Y.200 million (£11,700,000) loan under the recently extended limit of debentures issue, was put to the meeting and unanimously carried. The statement of accounts was approved as follows:—

	Year ended March 31, 1936 Thousand Yen.	(Thousand £)	Increase or decrease Over Last Year Thousand Yen.	(Thousand £)
Revenue				
Railways	134,686	(7,857)	+ 8,160	(+ 476)
Hotels	3,215	(187)	+ 318	(+ 19)
Ports and docks ..	14,394	(839)	— 1,336	(— 78)
Mines	92,559	(5,399)	+ 7,034	(+ 410)
Oil	6,963	(406)	+ 3,077	(+ 180)
Local Government Railway Zone ..	9,406	(549)	+ 2,133	(+ 124)
Various	6,668	(389)	+ 3,929	(+ 229)
Interest	34,267	(1,999)	+ 8,174	(+ 477)
Total	302,158	(17,625)	+ 31,489	(+1,837)
Expenditure				
Railways	50,655	(2,955)	— 2,624	(— 153)
Hotels	3,309	(193)	+ 440	(+ 26)
Ports and Docks ..	10,799	(630)	— 1,350	(— 79)
Mines	79,863	(4,659)	+ 4,727	(+ 276)
Oil	5,910	(345)	+ 2,497	(+ 146)
Local Government ..	23,624	(1,378)	+ 2,674	(+ 156)
Various	37,669	(2,197)	+ 12,463	(+ 727)
Interest	40,705	(2,374)	+ 9,505	(+ 554)
Total	252,534	(14,731)	+ 28,332	(+1,653)
Net revenue ..	49,624	(2,894)	+ 3,157	(+ 184)

Together with Y.12,649,000 (£738,000) brought forward from the previous year, the net surplus available is Y.62,273,743 (£3,632,600). It has been decided to distribute this sum between the following:—

	Yen.	£
Payment of ordinary dividend	24,800,000	(1,446,600)
Japanese Government share	11,350,014	(662,100)
Legal reserves	2,490,000	(145,300)
Special reserves	7,000,000	(408,300)
Directors' bonuses	400,000	(23,300)
Carried forward	16,233,729	(947,000)
	62,273,743	(3,632,600)

No special features were reported in the President's speech, but the railways remain the most profitable department in the company's undertakings.

* * * *

Steam Heating and Air Conditioning

TOWARDS the end of June the Mechanical Division of the Association of American Railways held its fifteenth annual meeting in Chicago, at which several reports were presented and some of them discussed. They have since been summarised and cover a wide range of subjects of interest and importance to railway mechanical engineers and in some cases at least are also of significance to those responsible for traffic working. Four railways submitted summaries of their experiences in the steam heating of passenger trains hauled by electric locomotives, and a report summarised these findings and also commented upon them. It was first of all pointed out that when passenger trains are being hauled by steam locomotives there is a large source of supply of steam for carriage heating purposes in the locomotive boiler and this supply is available at high pressure, *i.e.*, in most cases at about 200 lb. per sq. in. which by means of a reducing valve can be brought to the desired pressure and supplied to the steam train pipe line. In the past when rubber hose connections were practically the universal standard connection between the coaches, the maximum pressure was limited to about 130 lb. per sq. in., this being the limit that the hose could be expected to withstand without premature failure. On electric locomotives it is, however, necessary to have a boiler for the sole purpose of supplying steam for train heating or cooling purposes. Since the boiler, its auxiliaries, fuel oil tanks, and other parts take up valuable space in the cab and add weight, thereby making the layout and design of the traction apparatus more difficult and crowded, it is desirable if possible to limit the size of this equipment, while keeping it adequate to handle the maximum train demand for heating or cooling without restricting the train length below the hauling capacity of the locomotive.

In the early electric locomotives the boilers were designed for pressures of 100 to 120 lb. per sq. in., and at that time many wooden passenger carriages were in use, trains were short and the connections between the vehicles were of rubber hose, the train line being 1½ in. diameter and in some instances less. The present practice, however, is to operate long trains of 16 to 18 or more vehicles at higher speeds and at the same time provide better conditions both in regard to heating and cooling and this has created demands on the steam supply system that have necessitated revisions in the equipment. The use of a 2-in. train line and 2-in. metallic end connections between the cars to permit the passage of the required volume of steam with the minimum pressure drop is now more or less standard practice, and new boilers built for electric locomotives are designed for 200 or 220 lb. per sq. in. working pressure in order that there may be sufficient pressure at the rear of long trains for steam heating purposes, or air conditioning by the steam system, which latter requires 60 lb. a sq. in. at the rearmost vehicle for its proper operation. Another measure has been the adjustment of regulators to make possible the supply of steam to the coaches at 175 lb. per sq. in. or higher, and to minimise the drop between the boiler and the rear of the locomotive, pipes larger than 2 in have been used in some cases.

Reducing valves have been placed on each car for the purpose of maintaining the pressure constant at the regulator, or the use of diaphragms in regulators capable of efficiently handling steam at all pressures from zero to 200 lb., the purpose being to minimise the waste of steam and consequent loss of pressure and capacity to heat the train. Boilers of greater capacity are being provided on the electric locomotives now built, recent ones having had normal ratings of 3,250 and 4,700 lb. of steam an hour at 212° F. and upwards. Under forced ratings twice this evaporation is available. The amount of steam an hour required for each carriage varies with the particular type of vehicle, the speed, weather conditions, condition of the train pipe line and regulators, with respect to leaks and adjustments, and also with the difference between the temperature in the vehicle and that of the outside air. A fair average figure for a car temperature of 70° F. with outside temperature at zero and train line in good condition, is 200/250 lb. an hour. For air conditioning by steam about 250 lb. an hour for each car is required and since the outside air temperature is high when this equipment is used the condensation losses are at a minimum. Summarising these facts, it can be said that experience in heating or cooling of passenger trains hauled by electric locomotives shows that the ability to handle long trains is limited by the pressure avaliable at the rear of the locomotive, the train-line pressure conditions, and the capacity of the boiler to produce a sufficient quantity of steam.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

A Passenger in Palestine

London, July 18

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Perhaps some travel experiences of mine in the course of a recent trip to Palestine, Transjordan, and Syria may interest some of your readers in the light of the current disturbances in that part of the world.

On arrival at Haifa Central station, which was the starting point of several of my subsequent journeys, I asked the way from a rifled and steel-helmeted Palestinian policeman, and then a moment later I saw the place for myself. There is a bit of a monument with an engraving of an obsolete engine and a lot of writing I couldn't read; that was to the opening of the Hedjaz Railway.

That station had a company or so of soldiers camping in it, and across the sidings were carriages marked " H.R." or " P.R." The latter, the Palestine Railways, run south on standard gauge 260 miles to the Kantara ferry where they link up with Egypt, though the last 127 miles from Rafah to Kantara are technically Sinai Railways; the two concerns, however, built for military purposes between 1914 and 1918, form in practice one system. Over this P.R. main line there is, besides locals, one really good daily train each way with sleeping and restaurant cars, the whole trip of 281 miles from Haifa to Cairo being covered in from 14 to 16 hours.

My own first trip, however, was on the Hedjaz Railway and on the 14-mile branch from Haifa to Acre. The H.R., unlike the P.R., is narrow-gauge (105 mm.), and the Acre branch is third class only with ancient carriages and engines; the bulk of the traffic today goes in normal times by lorry and the branch is apparently unlikely to be modernised. The stock is of American day-coach type but with wooden seats; each carriage, however, has a couple of screened-off compartments for " Ladies Only," so allowing for the Moslem veiled women business. This arrangement holds on all classes of both the H.R. and the P.R.

I spent a happy afternoon at Acre in the police station, with the indignant crowd outside under the unfortunate delusion that I was a Jew. I didn't use my return half, as I would not willingly have walked through the streets to the railway station, but went home by car.

I also made a pleasing trip from Haifa to Ras Elain, with an Arab school breaking up on strike at Tulkarm and the crowd on the platform booing the train. I had a Polish Jew from the East End opposite me, and that miserable man actually carried my traps through the carriage at Ras Elain on condition that I walked behind him to " protect me, Mr. Englishman." Amused Arabs asked me to tell my friend that before they'd finished they'd cut his throat. The Polish Jew was not amused and dropped my bags with sheer funk.

The Hedjaz Railway is a line singularly complicated by post-war politics. From Haifa to Acre, and Haifa to Samahk is in Palestine, and your ticket is printed in English, Arabic, and Hebrew, the three official languages of the country; from Samahk to Deraa and from Deraa to Damascus is in French Syria, and from Deraa southwards is in Transjordan. To get a spare engine over to British Mandated Transjordan from British Mandated Palestine, it would be necessary to cross a stretch of Syria and pay French taxes.

Those engines as I saw them at Amman were huge ex-German War Reparations stock built especially for the narrow-gauge track. There is a train three days a week, but when I congratulated the stationmaster on his job he was not so sure about things; being stationmaster at Amman means also being in charge of every halt over the whole line. That was a long train, almost entirely made up of empty goods trucks. They come down from Damascus and go back empty; Transjordan manufactures nothing. We had one third class carriage packed almost to the roofs, and one composite first and second carriage, your correspondent being the only European on the train that day. This made it rather awkward with the Arab Legion policeman and his wanting five shillings for a passport registration fee, because the only Arabic I speak really well means " go away," which, of course, is not the proper thing to say to an official wanting five shillings.

Then as far as El Mafrak (that's the top of what rise there is) we dragged behind our engine a tank of water. They are careful in that country, and to climb a few feet the track would double on itself as though it were traversing the Pyrenees; the point is that there is no water to be had, and presumably the engine can't afford to waste power. Anyway it doesn't waste much power; it's 64 miles from Amman to Daraa, and it takes all but 4 hours.

El Mafrak is where the Arab children come and beg from the train; what they beg for is water. The climb is over, and if the Arab engine driver feels generous he will turn a tap and the children will race to fill up empty petrol cans. Water is precious there; petrol is for the asking. El Mafrak is where the Iraq Petroleum Company's desert oil-pipe line crosses, and it is a station full of experts and engineers and so forth. If ever the talked-about Haifa to Bagdad Railway is built, El Mafrak will be its junction point with the Transjordan Hedjaz line.

Then, just before Deraa, a line branches away east to the right; that's the French Syrian line that runs to Bosra up in the Druses' country and is very handy for carrying troops. At Deraa itself the passengers for Samahk and Palestine are shepherded into another waiting train; they need not show passports or have a customs examination, but they must not leave the station, and in fact gendarmes will see that they don't. But for Damascus you do have passports and customs, and then there is a little rail-motor train; it is first and third only, and with a second-class through ticket you pay about a shilling difference for the first class seat. Actually you go (or anyway I did) in the guard's little cubby-hole along with about three officials, a Syrian military policeman, and one or two other crowded-out passengers. The journey takes rather over three hours for the 76 miles from Deraa to Damascus, and it is quite an interesting ride, though possibly a trifle on the warm side.

From eight in the morning to somewhere about four in the almost tropical afternoon allows for plenty of reflection in a journey of 140 miles. But Damascus is a city worth getting to, and when you reach its Kenawat station you will eagerly think of the archæological treat in store for you with all those ancient buildings and so forth; you will also probably notice at the end of the platform and first to the left a quite modern building marked in beautiful French as " Buffet."

One other journey of mine calls for mention—from Jaffa to Jerusalem. I had a second class ticket and travelled first. There are no buses, and the train was packed to suffocation. The only first-classers I saw were a small party of Americans huddling miserably in the lavatory. My first class carriage was occupied by one Jewish Communist lady going to protective custody; two very jolly Arabs handcuffed together and going to prison, presumably for knifing a Jew; one Palestinian policeman in charge of prisoners and totally ignoring them and instead making a date with Arab Gay Lady turned out of the Can-Can Cabaret at Haifa, now closed down; and an American Missionary Lady, apparently of one of severer sects. At the junction of Ludd I got out and bought beer; everybody took it with applause except the Missionary and the Communist Lady and we entered the Holy City of Jerusalem a thoroughly happy party.

Yours faithfully,

JOHN GIBBONS

PUBLICATIONS RECEIVED

Mahaffy and Dodson's Road Traffic Acts and Orders. Second Edition. By R. P. Mahaffy. London: Butterworth & Co. (Publishers) Ltd., Bell Yard, Temple Bar. 10¼ in. × 6 in. × 2 in. 784 pp. Price 35s. net.—This volume is really a revised edition of previous works by the same authors, which brought the latest road law up to the end of January, 1934, by which time the main provisions of the Road and Rail Traffic Act, 1933, had become operative. In the work published in 1934 were incorporated all the available rulings under the Road Traffic Act, 1930, as well as the full text of the Act of 1933, but by that time there had been no decisions by the Traffic Commissioners or the Traffic Appeal Tribunal embodying the actual practice under the 1933 Act. The present work brings road law right up to April, 1936, in a most concise and readable fashion. In the first part are given in full the respective texts of the Road Traffic Act, 1930, the Road and Rail Traffic Act, 1933, and the Road Traffic Act, 1934, with notes on each section of those Acts where called for. In the second part, 366 pages are devoted to the Statutory Rules and Orders issued under the three Acts. A chronological list is given from 1930 up to March 26, 1936, with notes, illustrations of speed limit signs, index marks, etc. The third part includes the relevant sections of the London Passenger Transport Act, 1933, a chapter with notes on the taxation of motor vehicles, the Highway Code (in full), and the parking sections of the Restriction of Ribbon Development Act, 1935.

The introduction contains an admirable summary of road law to date. The whole of the Act of 1930 is given as it stood in 1930, but repealed passages are set out in italics and beneath them is placed the new text of 1933 or 1934, enclosing the new provision, in each case, in emphatic square brackets. By this method the reader can see how the law originally stood and exactly what changes have been made. There is a full and adequate index.

Stellwerks- und Blockanlagen (Interlocking and Block Installations), in Two Parts. Part I, Mechanische Sicherungseinrichtungen (Mechanical Safety Appliances); and Part 2, Elektrische Sicherungseinrichtungen (Electrical Safety Appliances). Berlin: VWL Gesellschaft, Columbushaus, Potsdamer Platz. Part I, 163 pp.; Part II, 137 pp. Each 8¼ in. × 6 in. Illustrated. Price RM. 2·84, post free.—The first edition of Part I was reviewed in our issue of September 21, 1934, and the present edition varies very little from it. Some errors have been corrected and a small amount of new matter is now incorporated—for example, on the new three-aspect distant signals.

Part II begins with a description of the Siemens & Halske lock-and-block apparatus, originally invented by Carl Frischen, with illustrations of the component parts and subsidiary devices, such as rail-contacts, signal repeaters, indicators, lever contacts, arm contacts, and signal replacers. Then follows an explanation of the principles of what is called in Germany the station block, with the locking details and some typical diagrams, after which the double and single line block instruments, used from station to station, are similarly treated, with coloured diagrams of the mechanical parts. Locking and manipulation tables are described and the conclusion treats of materials and specifications. There is a series of 171 questions on the subject and a good index. These books are part of a number now appearing for use in the staff training schools of the German State Railway and are fully up to the general high standard of the series. There is one mistake we notice on page 89, Part II, where the plungers for panels 4 and 5 of the right-hand block instrument have been drawn over panels 3 and 4 instead. An excellent idea of German mechanical signalling and block working can be gained from these well-printed publications, and a third part dealing with power signalling is to appear shortly.

Engineering Questions and Answers. Vol. I. Manchester: Emmott & Co. Ltd., 31, King Street West. London: 28, Bedford Street, W.C.2. 9¾ in. × 7½ in. 176 pp. Illustrated. Price 6s. net.—The "Questions and Answers" section of the *Mechanical World* has been a feature of that paper for a great many years, and in a preface to the above volume it is stated that frequent requests have been made that the answers should be published in book form. This is the first of a proposed series starting with the beginning of the year 1934, and the volume covers the answers of that year and part of 1935, whilst the projected second volume will continue from that point and carry on with the answers of 1936.

The value of the collection lies in the fact that the questions all arose originally out of the difficulties and problems encountered by engineers in the course of their work, and it is thought that the present record, in a convenient form for reference, will be of real service. We agree with this assumption, and have no hesitation in saying we think the book a wonderfully good six-shillingsworth. The language used can be followed without difficulty by all who may require to refer to it. The text is clearly printed and accompanied by numerous drawings and sketches. It covers a wide range of mechanical engineering subjects, including points connected with locomotive and other railway practice. The questions upon which the answers are based are briefly stated, and the answers set forth in adequate detail. We are giving this volume an easily accessible place on our bookshelves, as we feel certain that it will often prove useful for reference.

Aluminium Tubes and Pipes.—The extending use of aluminium for lightweight construction of railway vehicles will make the appearance of a book of specifications of tubes and pipes particularly useful to engineers. It is published by the British Aluminium Co. Ltd., Adelaide House, King William Street, E.C.4, and sets out the common sizes of the metal in this form, together with the weights in pure aluminium. The latter do not differ greatly from the weights of aluminium alloys, which are also widely used for such accessories as handrails, luggage racks, window guards, and similar fittings. A list of bends and sockets for aluminium pipe fittings concludes the booklet.

Heat-Resisting Steels. — Representative applications of Era heat-resisting steels are illustrated in a new catalogue published by the maker, Hadfields Limited, East Hecla and Hecla Works, Sheffield. A set of conveyor chains in this material is shown after being in service for eighteen months, and is seen still to be in perfect condition, whereas wrought-iron chains have to be renewed every six months. Five main types of Era steels are available, covering most requirements. For special conditions, other qualities can be supplied, and the makers are ready to place their expert advice at the service of customers in selecting the appropriate material both from the standard range and from the special grades for less generally encountered circumstances. The catalogue includes a table of data for rough machining of Era steels, the standard grades of which are sufficiently similar in their properties for different ones to be dealt with together.

All-Steel Cycle Parks.—Constructors' Catalogue No. 201/3, describes and illustrates the various forms of all-steel cycle park fabricated by Constructors Limited, Birmingham and London. With a primary view to economy in space, these parks can be supplied to accommodate anything from 10 to 1,000 cycles. In all cases every machine is immediately accessible without contact with adjacent cycles. Locking arrangements are provided to prevent the removal of wrong machines, and all cycles are protected against accidental damage. The parks are arranged either horizontally or sloping in a wide range of models to cover every requirement, and weather-proof covering can be provided if required. Municipal L.P.T.B., school, college, and workshop parks in various parts of the country are illustrated, and include motor cycle parking. In one instance 444 pedal machines are shown parked in a space 60 ft. × 30 ft. on the two-tier system, though for rapidity in parking single-tier parks are recommended. Those interested cannot do better than get in touch with this firm which has specialised in this line.

THE SCRAP HEAP

Many readers are, no doubt, familiar with the G.W.R. line which runs along the South Devon coast between Starcross and Teignmouth, a distance of 6½ miles. The Canadian National Railways, however, has a remarkable scenic section of line in Nova Scotia, paralleling over 250 miles of coastline, during which the Atlantic can be seen without break from the train window.

* * *

A new type of coach has been introduced by the compilers of *Bradshaw's Guide*. On page 4 of the July issue of that indispensable travel companion we read that the 10.45 a.m. from Paddington is equipped as far as Reading with a "buffer car." This is doubtless as a safeguard to passengers in the event of that train being caught up by the 11 a.m. express from Paddington to Penzance. Why has nobody ever thought previously of so elementary a safety precaution as this?

* * *

THE LONGEST BRITISH RAILWAY—BY NAME

A correspondent claims that the British railway with the longest name was incorporated 1846 under the title of the Sheffield, Rotherham, Barnsley, Wakefield, Huddersfield, and Goole Railway Company. This was divided into two sections; the northern portion, from Horbury Junction to Barnsley, was leased in perpetuity to the Manchester & Leeds Railway under powers obtained in the Act of incorporation, and finally vested in the Lancashire & Yorkshire Railway Company (successor to the Manchester & Leeds) in 1858. The southern portion, from Barnsley to Wincobank junction, on the old Sheffield & Rotherham line, about to be vested in the Midland at that date, was transferred to the South Yorkshire, Doncaster & Goole Railway in 1847, the date of the incorporation of the latter company, under powers contained in that Act.

* * *

PERMISSION TO BLAST!

In the signal box at Menheniot station, G.W.R. (in Cornwall), is an iron disc, 6 in. in diameter, painted red, which bears in white letters the inscription "G.W.R. Menheniot. Permission to Blast." Adjoining the station is a quarry, and the disc is the authority for the quarryman to blast within a specified area. Before this can be done, application has to be made to the stationmaster. The signalman is advised, and providing there is no train in the station the "blocking back" signal is sent to the signal boxes on each side. The disc is then handed to the quarry foreman, the station yard cleared, and a man posted with a red flag at the entrance, to prevent anyone entering. At one time, owing to the close proximity of the blasting operations the windows of the signal box and platform lamp cases were covered with a wire mesh to protect them from flying stones.

* * *

THE HABITS OF INSECT PESTS

Some interesting research experiments into the habits of insect pests are being carried out on the L.N.E.R. lines in the East Riding of Yorkshire by Mr. A. C. Hardy, Professor of Zoology at University College, Hull. Mr. Hardy is endeavouring to illustrate how these insect pests affect the farmer and is trying to obtain information about their dissemination by wind across the countryside. The apparatus consists of a galvanised cylinder, 2 ft. long and 1 ft. in diameter, fixed to the guard's van of a freight train. In the end of the cylinder facing the direction in which the train is travelling are a muslin net and glass tube known as an insect pest recorder; the various insect organisms are drawn into the net and trapped in the glass tube. The first experiment was made between York, Market Weighton, Beverley, and Hull with good results.

* * *

Some time ago the New York Railroad Club offered a prize of $25 for the best song composed by one of its members and sung to a tune, original or otherwise. These songs came in from time to time and were tried out by throwing them on the screen and having the whole crowd sing under the direction of H. C. Crowell, chairman of the music committee, and led by Fred W. Bender, signal engineer of the Jersey Central. A sound recording machine was used to determine the volume of applause. The songs which won out in the two elimination contests were sung again at the March meeting of the club and the first prize was awarded to George Herbert, assistant freight traffic manager of the Delaware, Lackawanna & Western.—*From the "Railway Age."*

No. 1 of a series of "claims prevention" posters recently issued by the Chief Goods Manager, Great Western Railway, for exhibition to the staff

Reproduction of an old oil painting showing a horse-drawn coach on the Whitby & Pickering Railway passing the Tunnel Inn, Grosmont. A mineral wagon may be seen on a siding on the extreme left of the picture. We are indebted to Mr. W. J. Oxtoby, Goods Agent, South Shields station, L.N.E.R., for a photograph of the original painting, which he sent us following the publication of the brief Whitby & Pickering centenary article in our issue of May 29

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

NEW ZEALAND

Renewal of Bridge near Canterbury

A creditable piece of work has recently been carried out by the engineering staff at Canterbury, involving the complete renewal of the Waipara River bridge, 773 ft. in length. The spectacular part of the work entailed the removal and replacement of 600 tons of material within a period of 21 hours between trains. The estimated scheduled timing proved very accurate, the labour leaving the work—which was then complete in all essentials—just as the second train arrived.

The old bridge was erected over 50 years ago, and, though some of the superstructure had been previously replaced, the ironbark piers recently renewed were driven about 1882. The spans consisted of 40-ft. steel plate girders. The replacement was carried out departmentally, and the new girders were fabricated in the Addington (Christchurch) workshops.

Due to the height and construction of the bridge, the superstructure renewal had to be undertaken in one shift between trains, 8 p.m. to 5 p.m. As no crane capable of lifting the girder spans was available, a derrick was built on to a flat truck for the purpose, the front bogie being strengthened to carry 32 instead of its normal load of 17 tons. Preliminary work included the cutting of the track into exact bridge span lengths and during the main operation 50 men worked practically continuously throughout the 21 hours.

Method of Replacing Superstructure

Working from one end of the bridge, one of two small cranes engaged on the work removed the old track section by section, allowing part of the old timber to fall away. From the other end came the derrick crane carrying a girder span which was lowered into position. Immediately the derrick crane left the bridge the other small crane took its place, carrying a section of completed track cut to fit exactly on to the new span. In this way 200 tons of bridge timbers and 80 tons of rails and sleepers were removed by the single crane working from the southern end of the bridge and dumped on the side of the old track, while from the other end 100 tons of rails and sleepers, 190 tons of decking and 200 cu. yd. of ballast were put in by the other small crane. As the work progressed the gangs became more accustomed to the routine, which called for speed and accuracy, and on one occasion only half an hour elapsed between the time the derrick crane placed one girder in position and the time it arrived with the next. The spans as well as the track and floor system in its entirety were in this way removed and replaced, and incidentally rail level was raised 1 ft. 8 in. above the old level.

SPAIN

Vital Representation by the Railways

The Railway Companies Association held an extraordinary general meeting in Madrid on June 15, and as a result of the deliberations of the members, representing practically all the Spanish companies, several important matters were brought to the notice of the Government. The first of these related to the Bill of June 5 establishing an intervention in the board of directors of the companies, and the association asks the Government to withdraw this Bill, on the grounds that it does not offer any solution for the railway problem but only side-tracks it. The Bill in question, as already mentioned in these columns, provides for the nomination by the State, of two directors on each board for every 50 millions, or fraction of that sum, of state capital, and also two directors elected from among the staff. It is pointed out that in the case of the Northern Company the scheme would give the State 20 directors against 18 appointed by the company, apart from the power of veto given by the Bill to the State directors.

The second matter represented by the association refers directly to the measures necessary for an equitable solution of the railway problem as a whole and details of it under nine heads, the principles which in the opinion of the companies must be observed in the drafting of any new railway law. The third matter relates to the present labour unrest and the impossibility of carrying on transport in the public service regularly in the face of a constant succession of strikes, many of which can be proved to have a political origin. Lastly the association brings to the notice of the Government the disastrous effect on railway traffic of the competition of the road, favoured by an almost complete freedom from taxation and from the multitudinous regulations which harass the railways and those who patronise them.

The Position of the Debenture Holders

The Minister of Public Works received in audience in Madrid a deputation nominated by the share- and debenture-holders of the Northern of Spain and Madrid Saragossa and Alicante Railway Companies at their last general meetings. The Minister listened sympathetically to the representations made by the deputation and assured the members that the Government was keenly interested in the satisfactory solution of the problem, which unfortunately they had received as a very undesirable legacy from their predecessors. He personally, was of the opinion that the legitimate rights of the debenture-holders and other creditors ought to be respected in whatever solution might be adopted, but that the shareholders were subject to the ordinary risks of industry. The deputation pointed out that in the case of the railways the ordinary risks of industry had been completely transformed by the restrictions placed by the Government on the liberty of the companies. The Minister said finally that this question of the railways would be considered at an early meeting of the Cabinet, when it was hoped that the preliminaries would be discussed of certain measures which would go to Congress for full and ample discussion, after being discussed in detail by a parliamentary commission.

INDIA

Railway Earnings

The total approximate gross earnings of all State-owned railways from April 1 to May 31, 1936, amounted to Rs. 16·27 crores, an increase of Rs. 34 lakhs over the figures for the corresponding period of the previous year. The working expenses for April, 1936, amounting to Rs. 410 lakhs, show an increase of Rs. 12 lakhs over the working expenses for the first month of the year 1935-36.

Standardisation of Railway Equipment

The Pope Committee laid considerable emphasis on the importance of organised research into measures conducive to the enhancement of efficiency in the working of the Indian railways. Valuable work in this direction has been done in the Central Standards Office attached to the Railway Board. This office was first set up in 1930 as an experimental measure, but the authorities soon realised the immense possibilities that lay before this institution, and the temporary establishment was converted into a permanent adjunct to the Railway Board. The activities of the Central Standards Office have recently been described in a press note issued by the Railway Department.

This branch of activity has for its general aim the standardisation of all materials and equipment used on the railways. Rolling stock, permanent way and signalling equipment, bridges and station buildings have all to be built in accordance with standard designs drawn up after the most careful investigation. The uniformity thus secured will not only facilitate railway working but will simplify the processes of manufacture and thus reduce the

cost of materials. Manufacturers will also be able to carry standard stocks which will be available to the railways without delay. The Standards office has already achieved notable results in the preparation of standard designs. Model designs of station buildings, signal boxes, bridges (steel and masonry), &c., are being produced. Before these model designs are finally adopted throughout the Indian railways, many elaborate experiments are taken in hand to test their suitability thoroughly.

Standard Bridges in H.T. Steel

The Railway Board's standard bridge girder designs have now been modified for use with high-tensile, instead of mild steel, for the various standards of loading, for broad and metre gauge, by the new department, as a result of a series of comprehensive tests under dead and live loads at varying speeds. This is but one example of the activities of the Standards office.

FRANCE

System of Underground Roads

A novel scheme for the construction of a system of underground roads has been laid before the Paris Municipal Council by M. Charles Trochu and endorsed by twenty of his fellow councillors. The scheme aims at clearing congested traffic from the streets in time of peace and providing shelters from air bombardments in time of war for the public and hospital services. The promoters of the plan estimate that in case of war the public would have half an hour available to seek shelter between the time hostile aircraft are signalled crossing the frontier and their arrival over Paris. To afford adequate protection from bombs and gases, they maintain that any system of specially equipped shelters must be constructed at a considerable depth. Most of the existing Metro tunnels run close beneath the street surfaces. Roads deeper down would serve as shelters. They would also provide direct routes for traffic passing through Paris to the suburbs. Some could also be used as direct Metro lines, thus solving a problem of long standing. Further, underground roads would give rapid communication with the airport of Le Bourget and other aerodromes near Paris.

It is proposed to finance the plan by means of tolls on vehicles and Government grants, as the State has an interest in the military side of the project and also in the decrease of unemployment by means of public works. The first underground road, it is suggested, might run from Le Bourget to the Porte de Saint-Cloud and it could be completed in time for the Paris Exhibition next year. It may be noted that the promoters seem rather sanguine concerning the speed of construction. Another point apparently unexplained is the difficulty of adequately ventilating underground roads. Gases from motors might prove a more permanent danger than those from invading aeroplanes.

QUEENSLAND

New Administrative Offices

The new administrative office building [which as announced in our issue of June 17 was opened on May 11, the day following the railway pageant.—ED. *R.G.*] flanks Anzac Memorial Square, is adjacent to Brisbane Central station, adjoins a block of other Government buildings, and is the first unit of the new railway administrative block. It consists of seven floors, in addition to the roof area, and houses the Minister, Commissioner, Secretary to the Commissioner, Chief Engineer, Chief Accountant and their respective staffs, as well as the Queensland Government Tourist Bureau, which is under the control of the Commissioner for Railways. This recently completed block and some of its internal arrangements are illustrated on page 148.

The new building, which is equipped with all modern conveniences, including pneumatic tubes for the conveyance of telegrams and letters, meets a much-felt want, as it has enabled the housing under one roof of staffs which were previously accommodated in three separate buildings. The locations of other sections of the administrative staffs are still somewhat scattered, but when additional units of the building are erected it will be possible to bring them together and to effect appreciable economies by means of amalgamation.

In constructing the building, advantage has been taken of the opportunity to feature the beautiful Queensland Ulam marble, which has been liberally used in dados on the ground and first floors, and which is remarkable for the beauty of its graining. The renowned exquisite cabinet timbers of Queensland have also been used to advantage in the parquetry and polished wooden floors and in panelling the walls of the principal rooms.

Tourist Bureau and Booking Office Facilities

The ground floor of the building has been devoted entirely to the Queensland tourist bureau and railway booking office, both of which are the finest of their kind in the Commonwealth. Two large display windows are provided on the street alignment. Recessed in the walls on the inside of the main hall is a number of show cases in which are displayed many beautiful specimens of coral, shells, etc. from the Great Barrier Reef, which parallels the coast of Queensland for more than two-thirds of its length, and which is regarded as one of the marine wonders of the world. In addition to a display room, where visitors may obtain an excellent knowledge of Queensland's scenic beauty and economic resources, there is a comfortably furnished public lounge and writing room, which has been the subject of many appreciative references by tourists.

Australian and New Zealand Conference

Coincident with the opening of the new railway offices on Monday, May 11, a conference of Australian and New Zealand railways officers was commenced therein. These conferences, which have been held periodically since 1898, have usually met in the southern capitals because of their more convenient location, and this is the first such conference held in Brisbane since 1899. The conference comprised representatives of the Permanent Way, Locomotive, Traffic, Accountancy and Electrical Departments, and was attended by delegates from all States of the Commonwealth, as well as New Zealand. The agenda, which was a lengthy one, covered a wide range of subjects of mutual interest to all systems, and all matters listed for discussion were dealt with in a most satisfactory manner. As is usual, the recommendations of the officers' conference will be submitted to a conference of Commissioners, which will be held in Brisbane during the week beginning July 13.

CHINA

Proposed Yellow River Bridge

The Ministry of Railways is considering the construction of a steel girder bridge across the Yellow River at Chilitien to carry a line connecting the Tatung-Puchow and the Lung-Hai Railways at the point. The estimated cost is $3,000,000, and the point of crossing the river is east of Tungkwan.

Change of Station Names

The Ministry has also decided that the names of certain well-known stations are to be changed. Ningpo is to become Ninghsien; whether the railway is to become the Shanghai-Hangchow-Ninghsien Railway is not stated. On the Nanking-Shanghai Railway, Changchow is to become Wuchin, and Soochow will be changed to Wuhsien. The similarity of the two new names may be a little confusing at first. It seems a pity to alter a well-known name like Soochow which has so long figured in literature and is one of the show places for visitors. "Heaven above, Soochow, and Hangchow, heaven below" is an old description of these places in Chinese literature.

Miscellaneous Notes

Train service on the Canton-Hankow line between certain points has been suspended temporarily owing to shortage of rolling stock.

A troop train left the rails near Chiehhsiu on the Tatung-Puchow Railway on June 10. Nineteen soldiers

are reported to have been killed and 20 others seriously injured.

Plans are being prepared for the extension of the Tangshan works of the Peiping - Liaoning (Peking - Mukden) Railway. Improved facilities for locomotive and coaching stock repairs will be provided and equipment will be purchased for machine tool making.

Arrangements are being made by the Shantung Provincial Government to take over the privately-owned Poshan railway at a cost of $780,000.

A new railway is being planned between Liucheng and Changten, with a branch to Lungwangmiao and Taokow, and another extension of it between Tsinan and Liucheng. Work will be begun in July.

Rebuilt Administration Offices and Station Buildings at Shanghai

It will be remembered that in the Chino-Japanese war of 1932, the North station at Shanghai was the special target of the Japanese air bombers during their attack on that city. At that time the administration offices of the Nanking-Shanghai and Shanghai-Hangchow-Ningpo Railways were situated in the same building and over the station offices [this building is illustrated in the centre of page 149.—ED. *R.G.*]. The staff was working until late in the evening prior to the night bombing which reduced the block to a mere shell [as shown in the lower left-hand illustration on that page.—ED.], and all but a part of the ground floor of that block has since been dismantled.

The shell of the ground floor has now been used as the nucleus of the new North station building [illustrated at the top of the page] and contains new and up-to-date traffic, booking and other offices. Meanwhile an extensive new block has been under construction on an adjacent site to house the administrative staffs of the two systems, whose principal officers are common to both. This fine structure [illustrated in the lower right-hand corner of the page] is now nearing completion, the illustration being prepared from an architect's drawing.

JAPAN

Tunnel Collapse

The middle section of the tunnel between Shimagahara and Okawara on the Kwansai main line from Nagoya to Osaka *via* Nara, suddenly collapsed in the early hours of May 28. The tunnel was under repair, and eight workmen were on the spot when the accident occurred; four of them were buried. Two of these were rescued, alive though seriously injured, after six hours work, but two were killed. Through passenger and goods trains have had to be diverted via Koto, and the local service has been curtailed to a few trains on the sections on each side of the tunnel; passengers from one side to the other are being carried by road with a delay of about two hours. The accident has caused serious inconvenience on this busy line, and it is expected that normal traffic will remain interrupted for at least six weeks.

EGYPT

De Luxe Coaches on Rapides

The State Railways carriage shops have just converted four first class carriages into *de luxe* coaches to run on the *rapide* trains between Cairo and Alexandria. These were put into service on June 15, and each has five compartments with certain embellishments such as dust proof windows, improved seating, etc., and one small saloon compartment to accommodate six persons. A supplement of *P*.5 is charged to travel on the *rapide* trains, and an additional supplement of *P*.5 to use the saloon compartments of the coaches. Each *rapide* train has two first-class *de luxe* coaches, a Pullman and three or four second class *de luxe* coaches. These trains which are scheduled for the greater portion of the journey at 90 km.p.h. with intermediate stops at Tanta and Sidi-Gabir, leave Cairo at 6.45 a.m. and 4.45 p.m., and Alexandria at 7.30 a.m. and 4.45 p.m. respectively.

Cheap Fares for the Interment of Saad Zaghloul Pasha

On June 19 the remains of the late Saad Zaghloul Pasha were removed with great reverence to their last resting place in the Mausoleum that had been specially constructed for the purpose. To assist those wishing to be present at the interment, the State Railways arranged to issue return tickets to Cairo at the ordinary single fare, for one or two days before the date of the ceremony—according to the distance to be travelled—which were available until the day following the interment. Great advantage was taken of this facility.

Railway Bridges over the Danube

The River Danube, one of the greatest rivers in Europe and the only great one to flow from west to east, passes through or touches seven countries, namely: Germany, Austria, Czechoslovakia, Hungary, Jugoslavia, Bulgaria, and Roumania. It is approximately 1,771 miles long from its source at the union of two streams, the Brigach and Brege, at Donaueschingen in the Black Forest about 2,180 ft. above sea level, to the Black Sea. It drains a basin estimated at 300,000 sq. miles and is navigable from Ulm, where it is joined by the Iller; below there it has 300 tributaries. While forming a valuable means of communication, it is naturally a hindrance to cross traffic unless bridged or tunnelled, and there are 29 railway bridges across it, as shown in the following table:—

Country	No. of bridges	In a distance of
		Miles
Germany	12	239
Austria	8	218
*Czechoslovakia and Hungary	1	106
Hungary	4	266
Jugoslavia	3	292
*Jugoslavia and Roumania	none	143
*Roumania and Bulgaria	none	246
Roumania	1	261

* On either bank, the river being the frontier

These bridges are naturally not all of the same degree of importance, some serving local interests only. Of the 12 in Germany, the most important are those at Ulm, Donauwörth, Ingolstadt, Regensburg, and Deggendorf, which all carry important through railway lines. The Regensburg bridge serves two, the east to west route Passau-Regensburg-Nuremberg-Würzburg-Frankfort (Main), and the north-south route from Berlin to Munich via Leipzig, Hof, and Regensburg. The eight bridges in Austria consist of three in Vienna and one each at Linz, Steyregg, Mauthausen, Krems, and Tulln. The river divides the provinces of Upper and Lower Austria.

Between Czechoslovakia and Hungary the Danube forms the frontier for a distance of 106 miles, but there is only one railway bridge between them at Komárno (Komorn), after which the river passes through Hungarian territory only for 266 miles more, with four railway routes crossing it, two at Budapest, one at Baia, and one at Dunaföldvar. In Jugoslavia the river divides the north-eastern provinces from the greater part of the country and there are three railway bridges, one at Belgrade and the others at Bogojevo and Novisad. Thence onwards there is only one more railway crossing, at Cernavoda in Roumania, there being none on the 143-mile stretch common to that country and Jugoslavia nor in the 246 miles shared with Bulgaria; this impedes communication between Sofia and Bucharest, especially in winter. Plans have been considered for making bridges between Turnu-Severin and Kladovo and for one between Giurgiu and Russe, or Calafat and Vidin, to overcome these difficulties, but they appear to have been dropped. Bulgaria would be glad to see communication set up via Roumania with Poland. The river varies from ¾ to 1¼ miles wide on these frontiers and a bridge would be costly. A way to finance it might be found in trade agreements between the countries concerned, and Germany would be glad to supply bridges in exchange for certain products, according to Dr. Weinberg, of Vienna, who recently published the above and other particulars in the *Zeitung des Vereins*.

XUM

NOMOGRAM FOR D.C. TRACK CIRCUITS

A simple graphic method of making all calculations for d.c. track circuits, including comparisons of different types of circuit and the easy adjustment of track resistances in situ

By NELS FORKHAMMER, Electrical Engineer, M.Sc., Copenhagen

MODERN signalling practice is making constantly increasing use of track circuits, and they are essential in all automatic signalling plants. Nowadays, too, they are being used widely for different types of warning signals at level crossings. Though in most of the larger installations, a.c. track circuits are used, there is still a large field of application for d.c. track circuits, as for instance in smaller installations, where it is difficult to arrange for an effective a.c. auxiliary supply. Signals at level crossings, too, are mostly supplied with d.c. relays, the current supply being either primary cells or trickle-charged accumulators.

The primary purpose of this article is to facilitate the calculation of d.c. track circuits, but the nomogram or calculating table may also be used for a.c. systems, where ohmic resistances are inserted between feed transformer and track, though not for systems with reactance or condenser feed. The main applications of the nomogram are:—

(1) To determine the correct setting of the track resistance to be inserted in the leads, when the minimum track voltage and minimum ballast resistance of the track circuit are given, together with relay characteristics and battery voltage.

(2) To determine the corresponding minimum train shunt value. Where a guaranteed minimum value of train shunt is wanted, it is possible by this means to ensure that a track circuit of given length will meet the requirements.

There are certain other applications also, that will be mentioned in due course.

Abbreviations and Symbols Used

To facilitate the following description, a short list of abbreviations and symbols is given below. The first and specially important point to note is that reciprocal values of resistances ("conductivities") are denoted by small letters, whereas the corresponding capitals are used for the resistances. The reciprocal value of 1,000 ohms, called 1 milli-Siemens, or 1 mS is used as the unit. The use of conductivities obviates the double fractions otherwise necessary in the calculations for two or more resistances in parallel. The unit mS is chosen so that practically all values appear as whole numbers, for the greater part in the interval 10 mS to 1,000 mS, corresponding to the interval 100 ohms to 1 ohm. The two separate divisions of scale III in the table may be used to convert resistance values into conductivity values and *vice versa*. B ohms is the minimum ballast resistance of the track between the rails, namely, when the ballast is wet and dirty, while b mS is the corresponding conductivity $= 1{,}000 \div B$. This conductivity has two components, (*a*) the conductivity of ballast and sleepers, proportional to the length of the section, l ft., and (*b*) the conductivity of the insulating joints, including point rod insulations proportional to the number of such joints, n.

Using constants which have been proved to give satisfactory results, the value b may be determined thus: When one rail is insulated and one battery terminal to earth, $b = 0{\cdot}3 \times l + 5 \times n$; but when both rails are insulated and equal as regards earth, $b = 0{\cdot}15 \times l + 5 \times n$. (These values correspond to a resistance of 200 ohms in each insulated joint, and a ballast resistance of 3·3 ohms per 1,000 ft. with one rail insulated, or 6·6 ohms per 1,000 ft. with both rails insulated. It must be noted, however that the full advantage of insulating both rails is only attained when no battery terminal is put to earth and the track resistance is divided up into fairly equal parts in the two leads. With stone ballast, in a dry climate, somewhat lower values of the constants may be used.

Proceeding with the symbols:—

R ohms is the total resistance of the relay circuit, *i.e.*, relay + relay leads + relay adjusting resistance (if any).

r mS is the corresponding conductivity $= 1{,}000 \div R$.

L ohms is the total resistance in the track leads from battery to track, *i.e.*, track resistance + resistance of feed cable.

T ohms is the train shunt value, *i.e.*, the value of resistance, which has to be shunted across the rails in order just to make the relay drop, the ballast being at the same time assumed to have its maximum resistance, $= \infty$.

t mS is the conductivity of the train shunt $= 1{,}000 \div T$.

T_B ohms is the shunt value necessary, when the ballast resistance is assumed to have its minimum value, B ohms. T_B is always larger than T and may be calculated as $T_B = 1{,}000 \div (t - b)$.

E volts is the nominal value of the feed battery, E being at the same time the maximum feed voltage.

E_1 volts (only for very exact calculations) is the lowest value of the feed voltage.

e_1 volts is the value of track voltage, when the relay is energised to its pick up value, to close its front contacts.

i_1 amps. is the pick up current of the relay. As $e_1 = i_1 \times R$, it follows that a relay adjusting resistance must be inserted in the relay leads of each relay, if the resistances of these leads vary much for the different track circuits, and if a fixed track voltage is wanted for all sections. This may be the case in a large layout with centralised track relays, especially with low-resistance relays (low track voltage).

e_2 volts is the value of track voltage, at which the relay is de-energised to its drop away value, to close its back contacts.

i_2 amps. is the drop away current of the relay, given on its label. When R is determined, e_2 is calculated as $i_2 \times R$.

Description of the Nomogram

The derivation of the formulæ used for the calculation of the nomogram, which consists of three scales, is given in the appendix. All calculations are carried out by connecting the scale divisions, corresponding to the two values known, with a pencil line, or a straight edge, and reading the value off the third scale, where the line or edge meets it. Scale I represents track voltage divided by battery voltage, $e \div E$. On this scale are read the values $e_1 \div E$, $e_1 \div E$ or $e_2 \div E$ (cf. below 4, 5 and 6). Scale II gives the values of track lead resistance, L ohms. Scale III gives the total conductivity between the rails. It carries two divisions, the one in ohms, the other with corresponding values of conductivity in milli-Siemens (mS, cfr. 2). It may be noted that 1 ohm corresponds to 1,000 mS, &c.

One application of scale III is to convert resistance values into conductivities and *vice versa*, *e.g.*, to determine the value $r = 1{,}000 \div R$: the whole of the scale may be used for this. For calculation by means of the diagram only the upper part of the scale is used, from 0·25 ohm (4,000 mS) to 50 ohms (20 mS), and not the lowest part enclosed in a rectangle from 50 ohms (20 mS) to 250 ohms (4 mS).

On the right-hand divisions of scale III are read the values, b, t, $b + r$ and $t + r$ (the two latter are necessary only with low-resistance relay circuits, whereas with relays of 50 to 100 ohms or more, r may usually be left out of

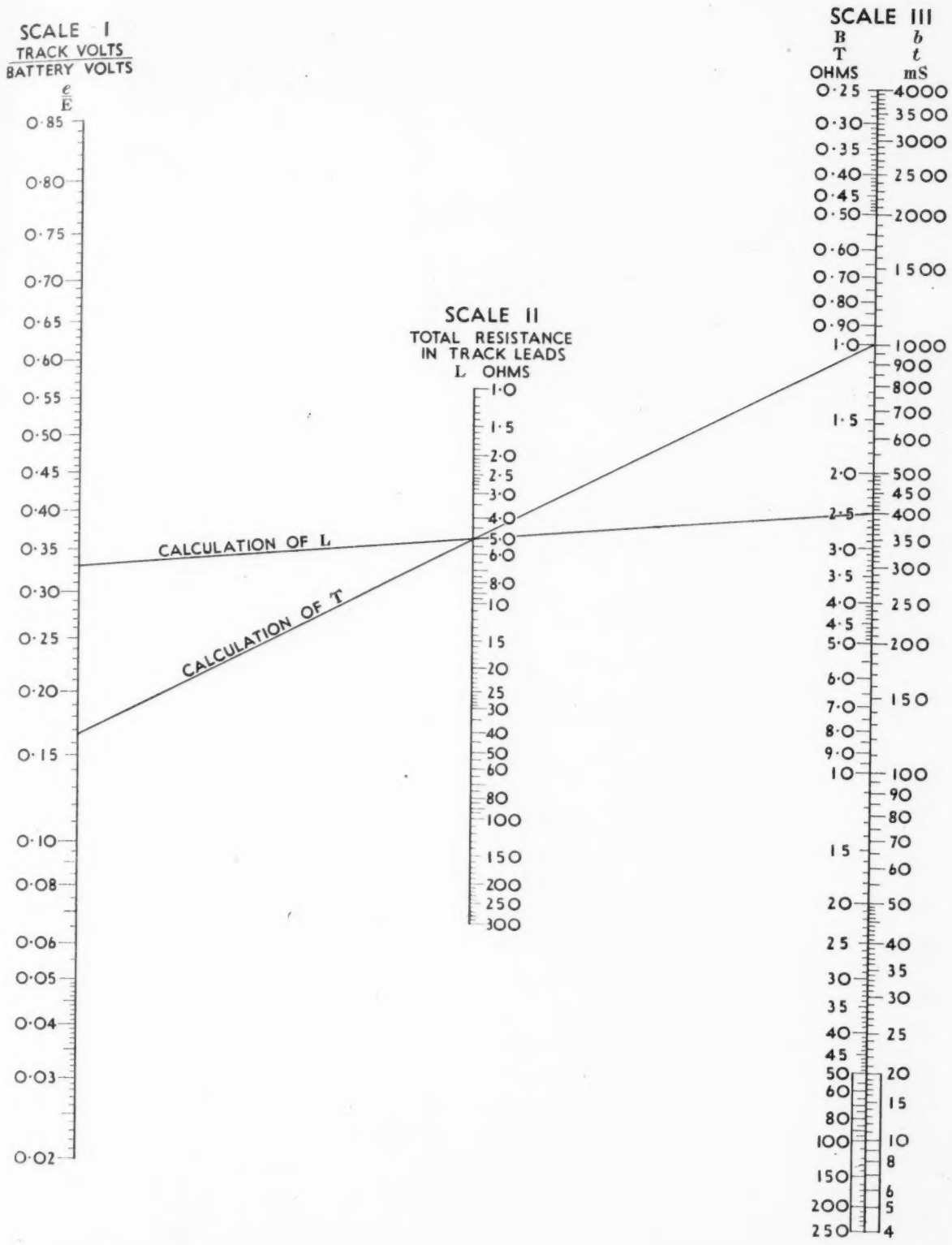


Fig. 1—Nomogram for Calculating Track Circuits

consideration in comparison with the much larger values of b and t). On the left-hand divisions are read the corresponding resistance values B ohms and T ohms. When the values of b and t are known, the value T_B (cf. above 2) is read off the left-hand division, corresponding to the value $t - b$ on the right.

Determination of the Track Lead Resistance L ohms

A numerical example of the calculation is given in brackets throughout the calculation, corresponding to the thin connecting line marked " Calculation of L " in Fig. 1. In the numerical example the section is taken as double-insulated, and the value b calculated correspondingly. For sections with only one rail insulated, the only difference is that the other expression for b is used.

Given :	Battery voltage	E volts	(6 v.)
	Minimum track voltage	e_1 ,,	(2 v.)
	Resistance of relay circuit	R ohms	(65)
	Length of section	l ft.	(2,500)
	Number of insulated joints ..	n	(2)

(a) By means of scale III, R is converted r mS (16).

(b) From the data of the section is found b mS ($2{,}500 \times 0{\cdot}15 + 2 \times 5 = 385$ mS).

(c) Scale division $e_1 \div E$ (0·33) on Scale I is connected with scale division $b + r$ (401) on scale III right.

(d) The intersecting point on scale II is L ohms (5·0).

NOTE.—An exact calculation will have to take into account that the value of minimum track voltage e_1 must be observed even with minimum value of battery voltage, E_1 volts. In this case $e_1 \div E_1$ is used for operation (c) instead of $e_1 \div E$. For practical applications, however, the nominal value of battery voltage may be used, as the value of the pick-up current of the relay itself possesses a certain margin of safety. If, in the numerical example, given above the value r is neglected, the value of L will be found to be 5·2 ohms instead of 5·0 ohms.

Determination of Train Shunt Value

(The numerical example is again given, and corresponds to the thin connecting line marked " Calculation of T " in Fig. 1.)

For the same section the calculation of train shunt value is made as follows:—

(a) Track voltage for relay drop away is given as e_2 volts (1·0).

(b) Scale division $e_2 \div E$ on scale I (0·165) is connected with scale division L (5·0) on scale II.

(c) The intersecting point on scale III is $t + r$ mS (1,000).

(d) From this value is subtracted r (16); on scale III is read, corresponding to t mS (984) on the right-hand divisions, the value T ohms (1·02) on the left-hand divisions.

(e) If the shunt value at minimum ballast resistance is wanted, then scale III is used to convert $t - b$ mS ($984 - 385 = 599$) into T_B ohms (1·7).

NOTE.—An exact calculation, as before, would have to consider what the critical conditions for the relay drop away are when the battery voltage has its maximum value. As this value has already been used, no alterations are necessary. A continuation of the numerical example without regard to r would make still less difference in the calculation of t than in the calculation of L.

Some Other Applications of the Table

From the above calculations it will be seen that the nomogram expresses the connection between three quantities, a track voltage ratio (scale I); a feed resistance value (scale II); and a track conductivity value (scale III). The formulæ governing this connection are contained in the Appendix. In addition to the calculations already described, all other calculations between the three quantities mentioned may be carried out by means of the diagram. Four cases may be mentioned :—

Case (i) : *Choice of Battery Voltages for a New Installation.*—In this case minimum values of ballast resistance R, of train shunt T and of track voltage e_1 are prescribed. When the type of relay is determined, then the values R and e_2 are also known. Resistances B, T and R are converted into the corresponding conductivities b, t and r, and the points $b + r$ and $t + r$ set out on scale III. The two triangles with a common angular point on scale II, shown by the thin lines in Fig. 1, are congruent, the distance between the scales being equal. The distance between the two points on scale III is taken with a pair of compasses. This distance is then (by trial) fitted in on scale I in between two values ($e_1 \div E$) and ($e_2 \div E$) in such a way that their ratio ($e_1 \div e_2$) has the value which corresponds to the chosen relay. The two points thus found determine the minimum value of battery voltage E, at which the requirements are fulfilled.

In the numerical example, this ratio is 2·0 : 1. It is seen that with a higher ratio (a less sensitive relay), a lower value of $e_1 \div E$ has to be chosen (*i.e.*, a higher battery voltage) and *vice versa*. With a ratio 2·2 : 1 in the example, $e_1 \div E$ has to be reduced from 0·33 to 0·20, *i.e.*, the feed voltage has to be raised 60 per cent. On the other hand, with a relay with a ratio 1·8 : 1, $e_1 \div E$ may be raised to 0·45, or the feed voltage chosen 25 per cent. lower. The calculation thus gives an indication as to the type of relay to be chosen for a given installation; it may be helpful, too, to decide, whether very long sections may with advantage be divided into two and a lower battery voltage used, in which case the reduced current cost at the lower feed voltage may compensate the higher cost of installation.

Case (ii) : *Adjustment on Site.*—In a large layout, with a great number of track circuits, a considerable time is required for the adjustments of track circuits, *i.e.*, the adjustment of the track resistance of each separate section, until a suitable track voltage is obtained. And, in addition to being cumbersome, this empirical adjustment is far from exact, as the value of track voltage aimed at must be judged by the engineer, taking into account the weather conditions, not only on the day of measurement, but also during the preceding period, to determine the state of the ballast. As only a very rough and theoretical judgment is possible, it will often be necessary to alter the adjustment of the track resistances after a time. This is most undesirable, as such re-adjustment has in most cases to be left to the lineman in charge and to his still less precise judgment.

By means of the diagram a much more reliable method of adjustment is possible. The values of resistances for each section are determined beforehand, and in the field only smaller adjustments—if any—are necessary. Re-adjustments will then practically never be necessary, and should never be carried out except by the engineer in charge of the plant, as any deviation from the values on which the calculations are based, must necessarily have its origin in special circumstances, such as leakage at insulating joints, which should be thoroughly investigated.

The calculation of L is carried out as described above, section for section, whereas the train shunt value need be determined only for one or two sections with the lowest ballast resistances. Meanwhile, $e_1 \div E$ has the same value for all sections and R and r also, so that the calculations may be contained in a table with the following columns: (1) Section No.; (2) Length of section, l ft. (3) Number of insulating joints, n. (4) b mS, calculated as mentioned above under 2. (5) $b + r$, the value to be inserted in scale III. (6) L ohms, as read off scale II. (7) Resistance of feed cable, to be subtracted from L. (8) Resulting necessary track resistance to be used. Even for a very large layout, with a hundred sections or so, the calculation of this set of values is a matter of a few hours only, once the form with its columns has been prepared, and a plan with sections and points in a suitable scale is available. It is advisable to have some additional columns, where regular test measurements may be entered, for comparison with later routine tests.

Case (iii) : *Choice of Battery Voltage for a Section Situated at a Great Distance from the Feed Battery.*—In this case the

resistance of the feed leads may be rather high, and a reduction of this resistance may be impossible if, for instance, an existing cable has to be used. If the resistance of the feed leads be L ohms, and the conductivities of ballast and relay circuit b and r respectively, then the determination of the track lead resistance is reversed, and the minimum value of $e_1 \div E$ determined. In this case, also, the calculation may be of great assistance to determine the most economical way of carrying out such an installation.

Case (iv) : *Routine Measurements of Ballast Conditions.*—For maintenance work regular test measurements of the ballast resistance of the various insulated tracks is of great importance. Such measurements are, however, practically impossible when carried out in the usual way, by disconnecting feed and relay leads and applying a measuring bridge or the like. Such measurements cannot be made by the unskilled maintenance staff, but necessitate the supervision of an engineer. At a station or on a line with heavy traffic, it is extremely difficult to make the measurements without delay to traffic. But when all values of L for a particular installation are known, an indirect measurement of the ballast resistance may be carried out sufficiently accurately with the section under normal working conditions. Moreover, the measurements at site consist only of two voltmeter readings, track and battery voltage, and these can be recorded with sufficient accuracy by the maintenance staff. The list of measurements for the different sections is then sent to the office of the District Engineer, where the ballast resistance is determined as described above. The only difference is that in this case L and $e_1 \div E$ are known, and $(b + r)$ are unknown. From the value $(b + r)$ thus determined, r is subtracted, and the actual value of B, corresponding to b, read off scale III. If the lineman adds to his report some general remarks as to the weather at the time of the measurements, a good check is obtained by a comparison of the actual values B with the calculated values and with the values obtained in former measurements.

It is the author's hope that the nomogram may prove useful to Signal Engineers, and that applications of it other than the few outlined above may be found. The material for this paper was collected by him during the two years he was in the service of the Danish State Railways, and he wishes to take this opportunity to thank the Signal Engineers of this system for previous measurements and calculations regarding track circuits, which have been of great use as a basis for the calculations described in this paper.

Appendix: Formulæ for the Table

Without going into details, a short summary of the formulæ developed as a basis for the diagram is given. Fig. 2 illustrates the most unfavourable conditions for the relay pick-up. Minimum battery voltage E_1 volts (or E, cfr. 4). Minimum ballast resistance B ohms (b mS $= 1{,}000 \div$ B). Total resistance in feed leads L ohms. Total resistance of relay circuit R ohms (r mS $= 1{,}000 \div$ R). The resistances R and B are connected in parallel, their resulting resistance being $\dfrac{1}{\frac{1}{B} + \frac{1}{R}} = \dfrac{1{,}000}{b + r}$. Note how the use of " conductivities " eliminates the double fractions.

When the track voltage has the value e_1 volts and the battery voltage is E_1 volts, then the voltage drop in the feed leads is $E_1 - e_1$ volts. The total current fed into the section from the battery may be expressed as :—

$$J = \frac{E_1 - e_1}{L} \text{ or as } J = \frac{\frac{e_1}{1{,}000}}{b + r} = \frac{e_1 \times (b + r)}{1{,}000}$$

Thus

$$\frac{E_1 - e_1}{L} = \frac{e_1 \times (b + r)}{1{,}000}$$

or

$$\frac{E_1}{e_1} - 1 = L \times \frac{b + r}{1{,}000}$$

Fig. 3, on the other hand, illustrates the most unfavourable conditions for the relay drop. Maximum battery voltage E volts. Maximum ballast resistance ∞ ohms not shown in figure. Train shunt value T ohms (t mS $= 1{,}000 \div$ T). Resistances of feeds and relay circuit as above, L and R. By reasoning analogous to the above, two expressions for the current are found :—

$$J' = \frac{E - e_2}{L} = \frac{e_1 \times (t + r)}{1{,}000}$$

or

$$\frac{E}{e_2} - 1 = L \times \frac{t + r}{1{,}000}$$

The resulting formulæ for both types of calculations are therefore analogous. The formula may be divided into three components, and for this type of formula a calculating table, consisting of three scales with logarithmic divisions, may be used. Accordingly, the three scales of the diagram, Fig. 1, in suitable logarithmic scale, are divided as follows :—Scale I with $\dfrac{E_1}{e_1} - 1 \left(\dfrac{E}{e_2} - 1\right)$, scale II with L, scale III with $b + r$ $(t + r)$.

A further simplification in the use of the table is obtained as follows : At each division of scale I is marked, *not* the value $(E \div e) - 1$ contained in the formula, but the corresponding value $(e \div E)$. That is, the point having the logarithmic value 4·0 $(E \div e = 5{\cdot}0)$ is marked 0·20 $(= e \div E)$, and so on. By means of this the value to be inserted in scale I gets a much more directly comprehensible meaning, " track voltage divided by battery voltage," and may at the same time be read directly off the slide rule, without the correction " minus one," which might otherwise cause errors, if it is left out through mistake, for instance.

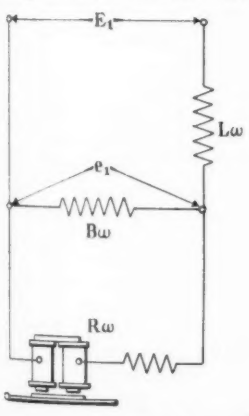


Fig. 2

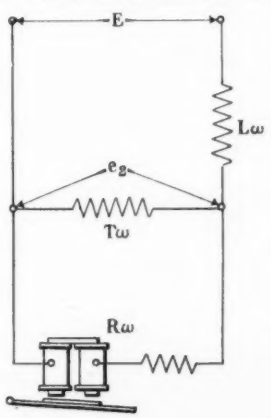


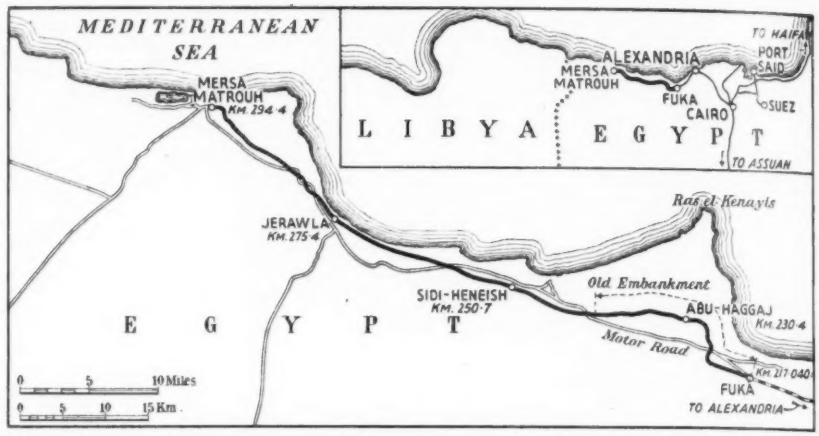
Fig. 3

Model Engineer Exhibition.—The eighteenth annual " Model Engineer " Exhibition, organised by Percival Marshall & Co. Ltd., 13-16, Fisher Street, London, W.C.1, will be held this year at the Royal Horticultural Hall, Westminster, from September 17 to 26. In addition to the usual extensive display of lathes, tools, and light engineering workshop equipment, there will be a large show of models entered in the competition section for the championship cup and other prizes. Leading model engineering clubs and societies will be represented by examples of members' work. The Royal Air Force is making an interesting display of its methods of technical training for aircraft apprentices.

THE FUKA TO MERSA MATROUH EXTENSION, EGYPTIAN STATE RAILWAYS

A brief description of this rapidly-constructed new strategic line with notes on the difficulties encountered and overcome

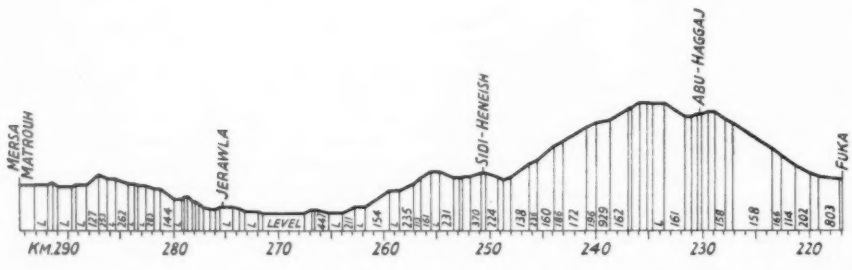
AS a precautionary measure it was decided last autumn to station a defensive force at Mersa Matrouh, a coastal town some 294 km. west of Alexandria and about 180 km. east of the Libyan frontier. The nearest railhead to Matrouh was Fuka, distant 77½ km. (48 miles), the terminus of the Alexandria-Fuka branch of the Egyptian State Railways. Between Fuka and Matrouh there was only an indifferent motor track quite inadequate as a line of communications for the size of the force at Matrouh and it was therefore decided in November to extend the railway thence from Fuka as quickly as possible. Fortunately this extension had already been surveyed, so that it was possible to start construction almost at once. There were also the remains of an old narrow gauge embankment stretching about 23 km. westwards from Fuka, that could be followed.



Sketch map and plan of the extension, showing position relative to Alexandria and the Libyan frontier, and also the motor road and old embankment

Gradients and Alignment

As speed in construction was all-important, and as it was uncertain whether the extension would remain as a permanency after return to normal conditions, gradients steeper than those prevailing elsewhere in Lower Egypt were permitted. Actually the westbound ruling gradient is 1 in 114 for a little over a mile in length, preceded by a mile of 1 in 200 and followed by 4½ miles averaging 1 in 160, in the course of a 12-mile continuous climb out of Fuka: 1¾ miles of 1 in 138 is the steepest gradient facing an eastbound train. In the first 18 km.—which follow the Khedive's old narrow gauge railway—the new line rises through 260 ft., only to fall nearly as much in the succeeding 14 km.: thereafter the profile is undulating. This 260-ft. rise is necessary to surmount the ridge which, stretching athwart the course of the line, terminates in Ras el Kenayis headland. In order to secure a reasonable gradient, the line swings northwards from its normally westerly direction, so as to make a sidelong climb over the ridge. After 5 km. in a northerly direction, the westerly course is resumed, and, with a slightly northerly tendency, is followed throughout the remaining 45 km. to Matrouh, roughly parallel to the coastline.



Gradient profile of extension, with kilometres from Alexandria and positions of stations

Permanent stations have been built as follow:—

	Distance from Fuka. km.	Distance apart km.
Abu-Haggaj	13·4	13·4
Sidi-Heneish ..	33·7	20·3
Jerawla	58·4	24·7
Matrouh	77·4	19·0

The permanent way used was collected from various sources. Some had been intended for renewals, some was released by taking up the second track between Ismailiya and Ferdan on the Port Said main line: more again was the result of dismantling sidings in different parts of the country. There are, consequently, no fewer than six sections of flat footed rail varying from 30 kg. to 47 kg. p.m., and also some 38-kg. bull-headed material in this extension, a fact which did not make for speed in laying.

There are four new bridges only: (1) 2 spans 7 m.; (2) 1 span 5 m.; (3) 2 spans 7 m.; and (4) 2 spans 7 m. All have reinforced concrete abutments and rolled-steel-joist girder spans. Two old girder bridges on the Khedive's narrow gauge line have also been reconditioned for standard gauge and loading. Concrete and Armco iron pipe culverts are used extensively.

Rate of Progress

Construction though it started in December was not in full swing before January 1. By January 31 formation had been completed for 40 km. and track laid for 38 km. On the military demand at this time for an intermediate railhead station, one was laid out at Sidi Heneish, 34 km. from Fuka, complete with two loops, a triangle for turning engines, ramp sidings, &c., and opened for traffic on February 8. A block station was opened at Abu Haggaj at the same time.

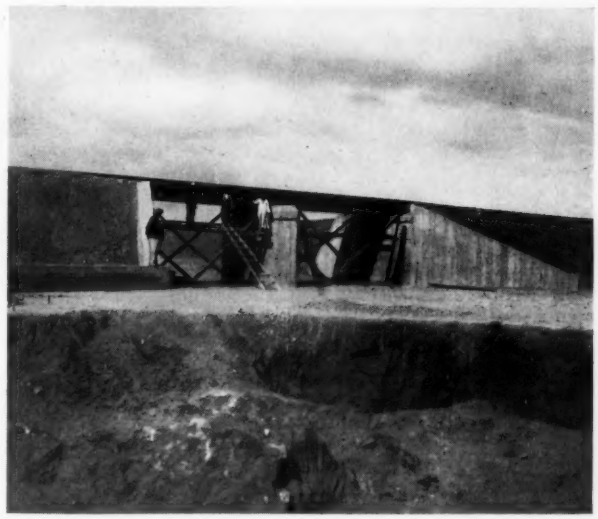
By the end of February, 66 km. of formation and 43 km.

of permanent way had been completed, and another station at Jerawla also. By March 17 formation was ready as far as km. 76 and permanent way to km. 74, only 3 km. short of Matrouh. This short distance, however, contained a cutting 600-m. long and 5-m. deep; as it would obviously delay final completion, a temporary terminus was opened just short of Matrouh to relieve the strain of army transport on the road, which by then was in a very bad state.

Work at Matrouh was completed on April 6, including 6 km. of sidings west of the station yard to serve various army depots, and complete permanent terminal arrangements: the service was extended to Matrouh on April 7.

Between January 1 and April 6 (97 days) therefore close on 100 km. of track were laid, formation completed—including this formidable cutting—bridges and culverts built, stations laid out and signalled, also three successive terminals brought into use, all with electric staff block working equipment and staff accommodation.

The average number of temporary labourers employed daily from the middle of December to the end of March was: in December, 800; in January, 2,900; in February, 4,700; and in March, 4,500. Supervising subordinate staff and trained platelayers and artisans numbered 150, the whole being under the supervision of the Resident Engineer and his Assistant.



Wadi Naghamish bridge, two spans each of 7 m., at km. 278

Sidi-Heneish station at km. 250·7

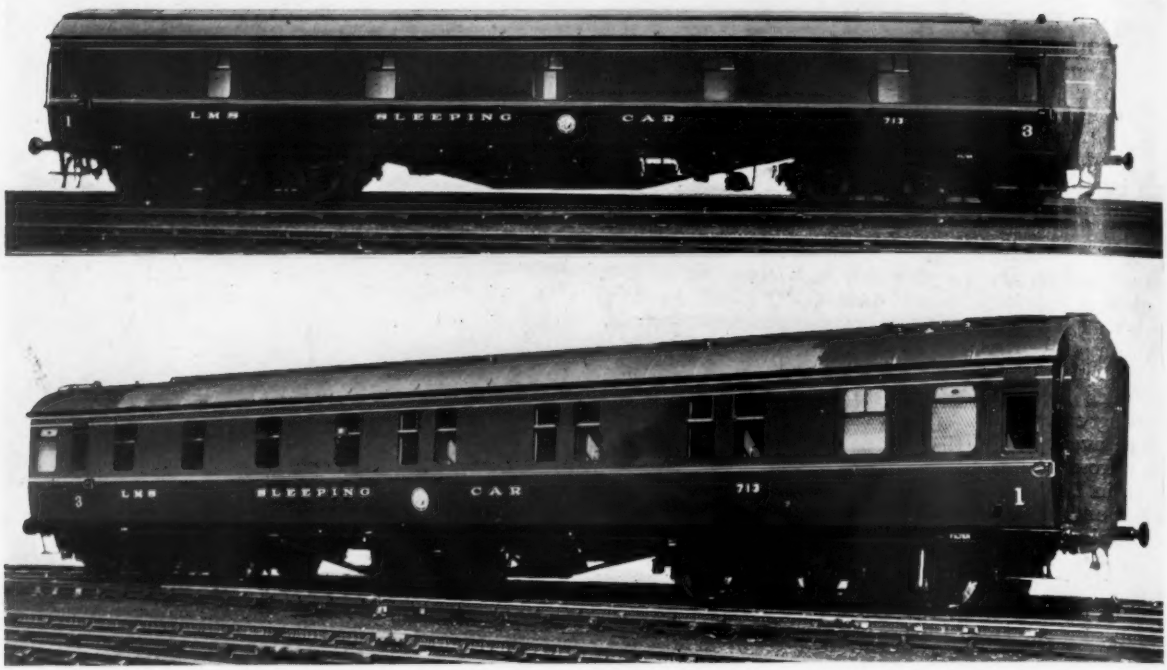
Cutting at km. 277·5

In addition to the complexity of the varying types of permanent way material, already referred to, there were complications connected with the remarshalling of material trains to suit light engine capacity. The 3,000-4,000 men employed and construction engines had to be supplied with water sent out in travelling tanks from Alexandria to railhead and distributed by motor lorry for the earthwork labour. All these considerations required very efficient organisation, on the success of which the engineering and locomotive staff are to be congratulated.

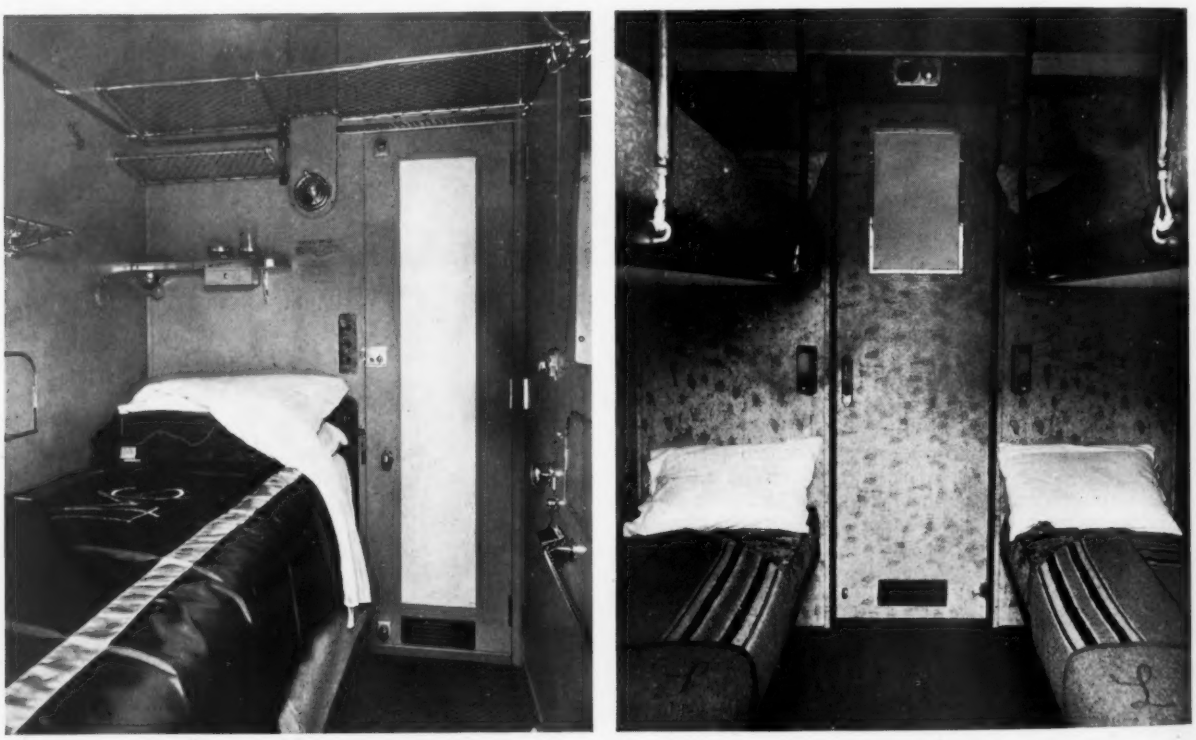
Finally, mention must be made of the weather, perhaps the greatest cause of trouble and delay. Intensive motor traffic had broken the crust of the desert to the degree that sandstorms were the rule rather than the exception: there was seldom a day when visibility was anything but nil. Actually the British working parties were frequently obliged to wear gas masks.

It is, therefore, to the lasting credit of all concerned that these great discomforts and very real hardships were borne by the whole staff with cheerfulness, and that pressure to secure continued progress was never relaxed.

A pair of rails complete with sleepers being carried by manual labour



Exterior views of new cars showing flush-sided body construction mounted on welded underframes and bogies



Interior views of first and third class compartments. The equipment includes Thermotank heating and ventilation, Rexine finished walls and Vi-spring mattresses

NEW COMPOSITE SLEEPING CARS, L.M.S.R.

(*See editorial reference on page* 131)

THE MECHANICS OF RAILWAY TRACK

Some pioneering investigation work now being carried out in India

FOR some months past the Central Standards Office attached to the Indian Railway Board has been carrying out important investigations into the variations or stresses in rails, and the stability of sleepers and rail joints under different wheel loads, to discover conditions under which the permanent way is capable of carrying heavier and faster trains. An investigation of this kind may indicate the possibility of a general acceleration of railway services without incurring heavy expenditure on long stretches of relaying. Various sections of the North Western Railway laid with different rails, different sleepers, ballasting and soil conditions have been examined with the aid of a special electrical apparatus known as the inductor telemeter, supplied by the Baldwin Southwark Corporation, Philadelphia, U.S.A., and with other apparatus designed and manufactured in India.

Track testing instruments affixed to the permanent way on a section of the North Western Railway main line

Three telemeters, or strain gauges, having a two-inch gauge length are bolted to the head and foot of the rail or to the fish plate. Two coils are wound on each telemeter which form one arm of a bridge circuit, supplied with a.c. current at 720 cycles from a dynamometer driven by storage cells. Strain in the rail is accompanied by movement of an armature in the telemeter which has the effect of unbalancing the bridge proportionally to the strain. Each telemeter forms part of a separate circuit. Unbalance of a bridge causes current to flow, after rectification, through a Duddell oscillograph, one of which is connected across each bridge, and simultaneous optical records, proportional to the strain to a time base, are obtained on a photographic film during the passage of the test load.

Rail deflection records at eight positions along the test lengths near to the telemeter positions are also obtained by means of four optical deflectometers, each of which contains a time, or load position marking mirror, two deflecting mirrors, and one seismograph mirror to enable the deflection record to be corrected for ground tremors where necessary. The investigators have used a special test train consisting of two of the heaviest types of four-wheeled wagons, loaded to 22½ tons an axle as against a normal load of 16 tons, and a special locomotive running dead with side and main rods removed, and all rotating masses carefully balanced in order to study the effect of a heavy unsprung mass. Tests have been carried out with this train at a range of speeds up to 70 m.p.h.

Tests under monsoon conditions and on important types of track not yet investigated, and tests in which the telemeters are to be attached to the running gear of vehicles to measure horizontal forces applied to the track, have yet to be made. Over 3,000 photographic records have been made to date. It is hoped that a preliminary report on the effects of vertical forces will be available before December next, and a final report and recommendations based on the whole range of tests during 1937.

Track testing instruments installed on the permanent way. Note the telemeters enclosed in silk bags for protection from dust, cinders, injector water, &c., attached to the railhead and fishplate

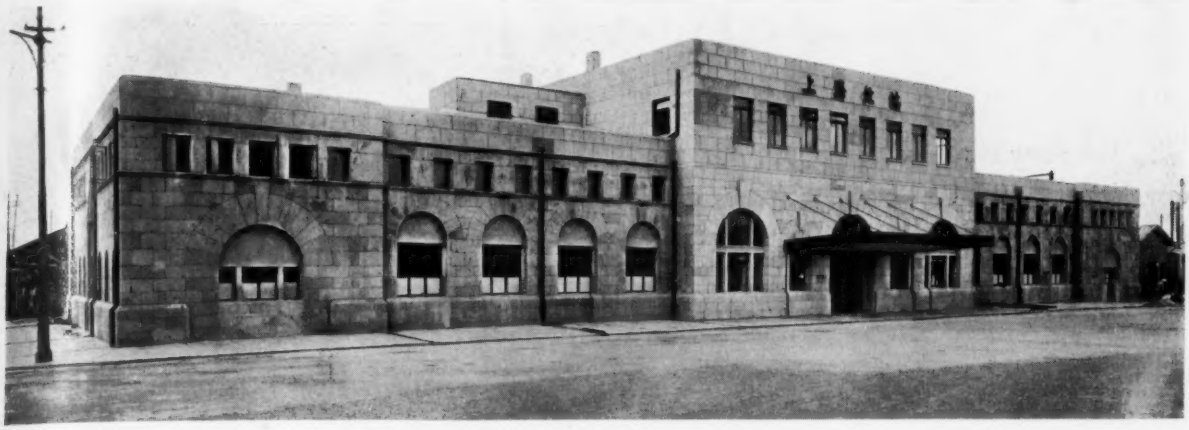
XUM

New Offices for Queensland Railways, Brisbane

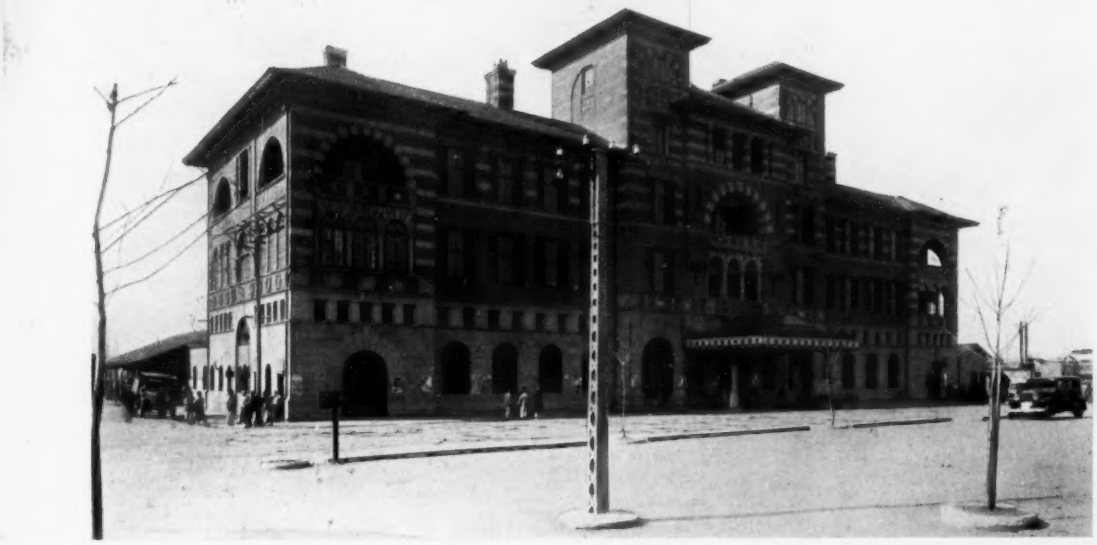
(*See letter from our Queensland correspondent on page* 138)

Above: View of railway booking office, ground floor

Left: Comfortably furnished public lounge and writing room, ground floor



Rebuilt traffic offices and booking office



Original administration offices built over station and traffic offices prior to bombing in 1932

Shanghai North station after having been bombed

New administration building now nearing completion

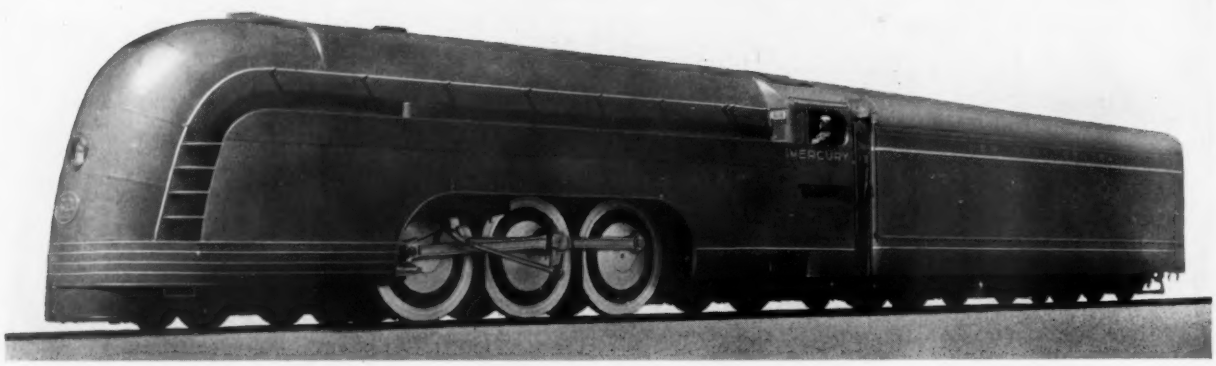
NEW STATION AND ADMINISTRATION OFFICE BUILDINGS AT SHANGHAI NORTH, NANKING—SHANGHAI AND SHANGHAI—HANGCHOW—NINGPO RAILWAYS

(*See Overseas notes on page* 139)

The Mercury Express, New York Central Lines

(*See editorial note on page* 131)

Right: Streamlined express, The Mercury, photographed at speed on its 170-min. run over the 165 miles between Cleveland and Detroit



Above: Streamlined Pacific locomotive of The Mercury, showing the disc-centre coupled wheels, illuminated by concealed floodlights while the train is in motion

Left: Special attention has been paid to the furnishing of the passenger accommodation on The Mercury, and this interior view of the parlour car shows the informal and domestic atmosphere created by the movable armchairs, tables and reading lamps. The colouring is in warm tones of tan, brown, rust, and gold

RAILWAY NEWS SECTION

PERSONAL

A memorial plaque is to be placed on the wall of the King's Arms Hotel at Bedlington in Northumberland, in memory of Sir Daniel Gooch, who was born there in 1816. He was Locomotive Superintendent of the G.W.R. from August, 1837, to October, 1864, and was Chairman of the company from November, 1865, to October, 1889.

SOUTH AFRICAN STAFF CHANGES

Mr. G. J. A. Lindenberg, Airways Manager, Johannesburg, to be Mechanical Engineer, Durban.

Mr. M. M. Laubser, Mechanical Engineer, Durban, to be Assistant Chief Mechanical Engineer, Pretoria.

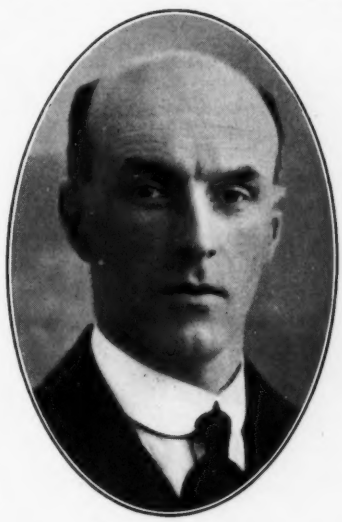
Dr. C. V. Von Abo, District Engineer, Durban, to be System Engineer, Pretoria.

Mr. F. C. M. Wilter, District Catering Manager, Braamfontein, to be Assistant Catering Manager, Johannesburg.

Mr. William Hill, European Accountant, Canadian Pacific Steamships Limited, retired on pension on June 30, after 48 years' service with the Allan Line & Canadian Pacific Companies.

Mr. G. H. Roussillion, sometime Construction Engineer, Way & Works Department, Buenos Ayres Western Railway, whose death we announced in our issue of June 19, spent his earlier years in the Locomotive Running Department of the L.B.S.C.R., with building contractors, and in the Royal Engineers, with which corps he saw service in India and Egypt and was wounded in the siege of Alexandria. Purchasing his discharge from the Army, he went to Argentina in 1890, there to be employed successively in the B.A.G.S., B.A. & Rosario and Central Argentine Railway Construction Departments. In 1901 he joined the B.A. Western Railway which he served until his retirement in 1923. The more important works with which he was connected were the Liniers workshops, the Low Level works from Caballito to Once, the reconstructed permanent way shops at Haedo, and wide construction works in connection with the suburban electrification, costing several million pounds in all. He was very popular and had innumerable friends in all walks of life, among whom he numbered Sir Follett Holt, Mr. J. A. Goudge, Sir Ernest Moir, and Sir John Hunter of Arrols. Mr. Roussillion devoted his retirement to study and the simplification and revision of mathematical formulæ, and to the compilation of a history of his 40 years' activities in Argentina, where the British community in particular and the country generally lose by his death a genuine friend, a great worker and true gentleman.

Mr. William Gourley, who, as announced in THE RAILWAY GAZETTE of July 10, has been appointed District Engineer, Edinburgh, L.M.S.R., joined the Caledonian Railway in 1901, and until 1910 was engaged upon new works, &c., in the Chief Engineer's office, under the late Mr. Donald A. Matheson. In September of the latter year he was transferred to the Western District, under Mr. J. H. Anderson,



Mr. W. Gourley,
Appointed District Engineer, Edinburgh, L.M.S.R.

and was there engaged on maintenance work for ten years. In 1920 he rejoined the Chief Engineer's office and worked in the maintenance section of it until, in 1928, he was appointed Assistant in Maintenance of Way & Works in that office, which had then become the Divisional Engineer's office in Scotland of the London Midland & Scottish group. It is this appointment from which Mr. Gourley now goes to Edinburgh as District Engineer.

Mr. Arthur E. Heskett, General Manager of the Antofagasta (Chili) & Bolivia Railway (Chilean section), has been awarded the Order of Merit (Official Grade) for valuable services to the Republic. The decoration was conferred by General Jorge Bari, Commander-in-Chief of the First Division of the Army, on behalf of the Chilean Minister of Foreign Affairs, at a banquet given in honour of Mr. Heskett at the Auto Club, Antofagasta, at which many Government officials and other prominent people were present.

INDIAN RAILWAY STAFF CHANGES

Sir Maurice Brayshay, Agent of the B.B. & C.I.R., has been granted 4¾ months' leave, as from June 22, and Mr. J. J. C. Paterson, Locomotive & Carriage Superintendent has been appointed to act as Agent during his absence.

Mr. R. E. Marriott has been promoted provisionally permanent Deputy Chief Engineer, State Railways, as from April 11, but continues to be employed as Divisional Superintendent, E.I.R.

Mr. T. S. Sankara Aiyar, B.A., B.E., Director, Railway Board, has been granted 2½ months' leave as from May 18, and Khan Bahadur Barkat Ali officiates in his place.

Mr. G. H. A. Wood has been appointed to officiate as Deputy Chief Accounts Officer, E.B.R., from May 6.

Mr. P. C. Chaudhuri has been appointed to officiate as Deputy Chief Accounts Officer, E.I.R., from May 7.

Mr. P. Wood has been appointed to officiate as Chief Accounts Officer, G.I.P.R., as from May 18, in place of Mr. H. C. Norbury, granted six months' leave. Mr. F. F. Parish officiates as Deputy Chief Accounts Officer in place of Mr. Wood.

Mr. G. E. Berkley has been appointed to officiate as Chief Traffic Manager, G.I.P.R., as from May 18. Mr. K. J. McNeill has been officiating as Deputy Traffic Manager as from the same date.

Mr. J. H. Rickie on return from leave resumed duty as Officiating Chief Engineer, Burma Railways, on May 14: Mr. C. G. T. Toller, who had been officiating in his place, then reverted to Deputy Chief Engineer.

Mr. L. Barber has been appointed to officiate as Chief Electrical Engineer, G.I.P.R., as from April 9; the appointment was confirmed on May 23.

Mr. D. M. S. Robertson, V.D., has been confirmed as Chief Operating Superintendent, E.I.R.

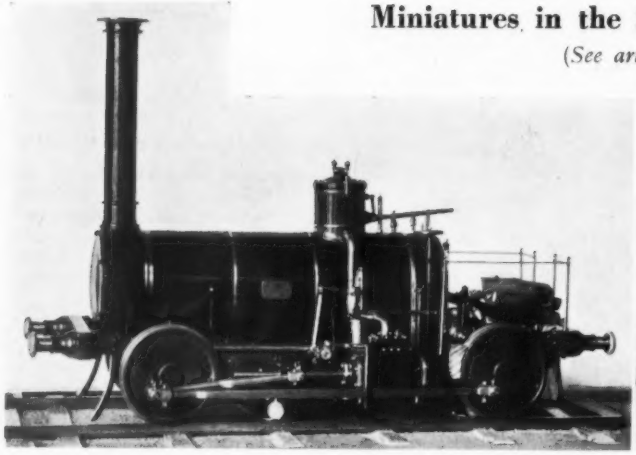
Mr. W. R. R. M. Bennet, Signal Engineer, E.B.R., has been permitted to retire from the Service from May 22.

Mr. E. M. Cory has been appointed to officiate as Chief Engineer, G.I.P.R., in place of Mr. R. Sephton, granted 5¾ months' leave, as from May 18. Mr. Cory has been succeeded as Officiating Deputy Chief Engineer, Construction, by Mr. F. G. Langdon.

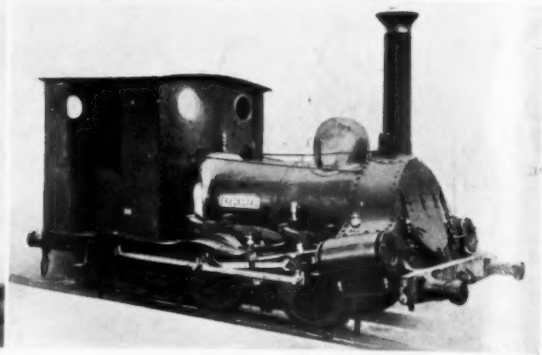
Mr. A. J. Lee, Assistant Chief Mechanical Engineer, Entre Rios and Argentine North Eastern Railways, has retired from that position and sailed for England on July 3. After a short holiday, he will proceed to Brazil to take up an appointment with the Great Western of Brazil Railway. Mr. Lee served his apprenticeship with

Miniatures in the Stockholm Railways Museum

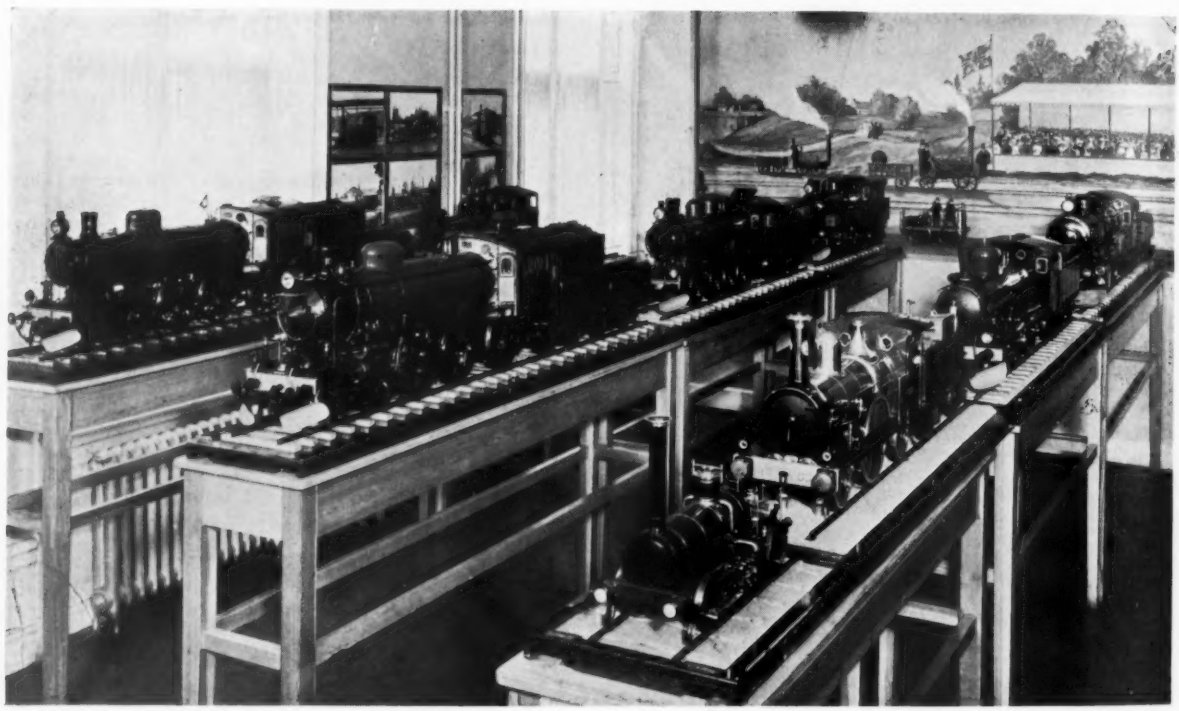
(See article on opposite page)



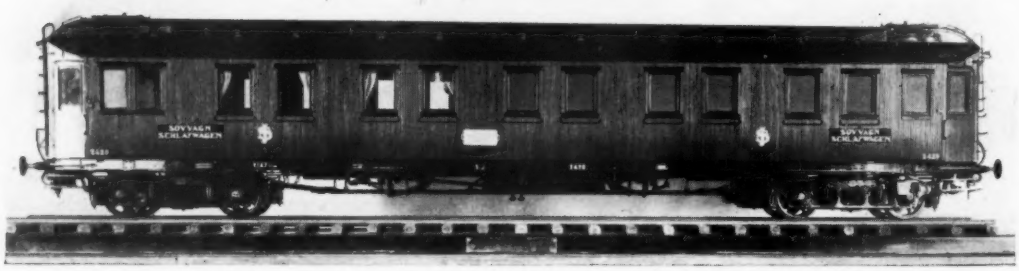
Model of the first locomotive used in Sweden



An old time shunting engine



Correctly-proportioned working models of historic and modern Swedish locomotives, with large mural scene of the Rainhill trials of October 9, 1829, in which John Ericsson's locomotive "Novelty" participated



Model of a first class Swedish sleeping car

Richard Garnett & Sons Ltd., and subsequently spent four years with Plenty & Son Ltd., marine engineers, of which firm he became Assistant Works Manager. He went to India later as First Assistant to the Works Engineer, Calcutta Port Commissioners. During the war he served on the Indian Munitions Board in different capacities, and afterwards under the Department of Industries, until his return to England in 1923. Consequent on the reorganisation of the Mechanical Department of the Entre Rios & Argentine North Eastern Railways, Mr. Lee was appointed to the Mechanical Department of the latter system, and in 1934 became Works Manager. In 1928 he was promoted to be Chief of the Mechanical Department of the same railway, and in 1930 he was appointed Assistant Chief Mechanical Engineer of both companies. He is a Member of the Institution of Locomotive Engineers, and an Associate Member of the Institution of Engineers (India).

The Rt. Hon. Baron Wakehurst, former Chairman of the Southern Railway Company, whose death we recorded in our issue of May 8, left estate valued at £154,574 (£111,453 net).

Field Marshal Viscount Allenby, who was a Director of the Egyptian Delta Light Railways, left estate valued at £29,545 (£28,354 net).

Sir Alexander Cooper, late Director of Vickers-Armstrongs Limited and other concerns, whose death we announced in our issue of March 27, left estate valued at £42,507 (£38,811 net).

The Stockholm Railways Museum

By RODGER L. SIMONS

(*See illustrations opposite*)

Accessibility is not an outstanding feature of the Railways Museum in Stockholm. Yet—obscurely tucked away where a tourist would hardly expect to find it—the museum is an extremely interesting spot. With the exception of one of the earlier historical models, which leisurely jaunts back and forth along a ten-foot track, all the locomotives and cars are stationary. Raised the barest trifle above the rails to facilitate motion without movement, each locomotive may be set working by the touch of a button controlling an electric motor.

Locomotive cabs, and passenger, sleeping, and dining cars are all illuminated from within. Through the windows, one may study the minutest detail of fitment and furnishing. Even the royal crest is embroidered on towels and pillow slips, exactly as in reality. In all, several rooms are occupied by the car and locomotive models alone. Students of English railway history will be interested to see at one end of the main locomotive display hall a mural decoration representing a scene during the famous Rainhill locomotive contest of 1829, with the *Rocket* in the lead.

Adjoining the suite in which are the railway models is a room containing small-scale reproductions of auxiliary equipment and facilities—trestles, car ferries, road ballasting methods—while in another room is a model snow plough, grinding and churning all day at a pile of confetti snow. Still other rooms house full-size specimens of railway equipment—signals, sleepers, and rails, electric cable, points and crossings, and other accessories. Adjacent to the exhibit rooms of the Stockholm Railways Museum is an extensive library of reports, printed matter and other data pertaining to one of Sweden's major national institutions—her railway system.

This system had its practical inception in 1856 with the building of a State-subsidised line between the Swedish communities of Örebro and Nora. The father and founder of the Swedish railways was Nils Ericson, assistant to Count Baltzar von Platen in the construction of the famous Göta canal, and later Chief Engineer of that project. A brother to the equally talented John Ericsson of nautical engineering repute, Nils Ericson dropped one "s" from his surname when raised to the nobility in 1854.

"Cost will be forgotten," Ericson used to say of his railway project, "but work that does not meet specifications or expectations will never be forgotten." His unwavering insistence on this rather characteristic Swedish *credo* brought Nils Ericson a reputation for such integrity and insight that in time almost every detail of his recommendations was accepted as standard practice on the Swedish railways. In tribute to this man, to whom they and their railroads owe so much, the Swedes have proudly mounted a bust of Nils Ericson over the entrance to the Stockholm Railways Museum.

Southern Railway "Schools" Class 4-4-0 Performance

(*See editorial note on page* 131)

The capabilities of the "Schools" class three-cylinder 4-4-0's are well illustrated by two recent runs on the 80-minute London-Folkestone service. On the 12.55 p.m. (Saturdays only) from Charing Cross, loaded to 9 coaches, 282 tons tare, 300 tons gross, No. 916, *Whitgift*, was delayed by signal just beyond London Bridge, but recovered well to pass Sevenoaks on time, and thereafter steadily gained on schedule until Ashford was passed with 2½ min. in hand; this was just sufficient to offset a severe relaying slack near Smeeth, and Folkestone was reached in 80 min. 8 sec., or 75½ min. net, for the 69.9 miles. Throughout the run cut-off was constantly varied to suit every change in gradient, and on the easily graded length between Tonbridge and Ashford alone there were no fewer than 13 changes. From New Cross up to Knockholt full regulator was used throughout; cut-off was increased to 29 per cent. as the summit was neared, and this sustained 45 m.p.h. on the 1 in 120 grade.

On easy stretches very full use was made of the first port of the regulator, and with this valve and 20 per cent. cut-off a speed of 69 m.p.h. was sustained on the level near Headcorn. The maximum speed on the trip, 78 m.p.h., occurred on the descent from Sevenoaks tunnel. For the first few miles here even the first port of the regulator had been almost closed, but when it was fully opened, in conjunction with 17 per cent. cut-off, the acceleration became very rapid and speed was still steadily rising when steam was shut off for the Tonbridge slack. On the Tonbridge-Ashford stretch, which is on the average against the engine and includes in the aggregate about 8 miles at 1 in 250-290, cut-off was varied between 18 and 24 per cent.; the main regulator, about half open, was used only from Headcorn up to Chart siding, and here speed did not fall below 63 m.p.h. on the 1 in 277 grade.

On the 5.10 p.m. up from Folkestone with engine No. 921, *Shrewsbury*, and the same load, the work was equally satisfactory. Except for the initial 5½ miles at 1 in 266 up to Westenhanger, the first port of the regulator was used throughout, even up to Sevenoaks tunnel. The very fast booking to Tonbridge, 39½ min. start to pass for the 40.4 miles, was improved upon by halt a minute, speed having averaged 72.2 m.p.h. over the 25.6 miles from Smeeth to Paddock Wood. Twenty-five per cent. cut-off was used throughout this length, but for the 1 in 122 ascent to Sevenoaks tunnel 31 per cent. was needed; here speed fell to 38 m.p.h. On this journey also a permanent way slack was in force near the finish, at Hither Green, but sufficient time was in hand to allow for this, and Waterloo Junction, 69.2 miles, was reached in 76 min. 20 sec.; after a halt of 43 seconds, Charing Cross was reached in exactly 80 min. from Folkestone.

XUM

Railway Students' Association Annual Convention

The annual convention of the Railway Students' Association of the London School of Economics, London University, was held at Southampton last week-end, July 16-20. The headquarters were at Highfield Hall, a hostel of the University of Southampton.

The main party left Waterloo on the Thursday evening, and on arrival at Southampton inspected the works recently completed at the new Central station, described in THE RAILWAY GAZETTE for September 13, 1935. On Friday morning the convention was formally opened by Lt.-Col. Gilbert S. Szlumper, Assistant General Manager, Southern Railway, and President of the association, who expressed his appreciation of the educational work carried on by the association. He also reminded his listeners of the fact that as railway servants they were also in effect public servants.

Mr. E. Hight, Divisional Superintendent, Southern Railway, who then offered a welcome on behalf of the transport undertakings of Southampton and district, pointed to the diversity of Southern Railway interests in the neighbourhood. In addition to the docks, the railway company had interests in both of the local road passenger transport operating companies, and in various air services flying daily from the municipal airport.

Mr. R. A. Hodgson, B. Com., of the Department of Economics, Southampton University, who was introduced by Mr. C. E. R. Sherrington, then presented a paper entitled "British Overseas Trade Since the War and its Relation to Transport." The rather gloomy prospects which Mr. Hodgson foresaw produced a lively discussion, and in reply he confessed that he saw little hope of any great measure of recovery until such time as we might return to a free trade policy.

In the afternoon visits were paid to the new Southern Railway docks, where in the company of Mr. Pelly and Mr. F. E. Wentworth-Shields an inspection was made of the new quays, transit sheds, and the King George V graving dock, in which was berthed the Cunard White Star liner, *Queen Mary*. These works were fully described and illustrated in THE RAILWAY GAZETTE for January 20 and July 28, 1933. Later the party was taken over Rank's flour mills, the first industrial building to be erected on the reclaimed land behind the new quays.

Tea was taken at the Civic Centre at the invitation of the Mayor of Southampton, Alderman T. H. Sanders, who extended an official welcome on behalf of the town. The opportunity was then taken of inspecting the fine new municipal buildings recently erected at a cost of about £750,000. After tea the party was conveyed to the municipal airport near Eastleigh, where it was possible to observe the operations of Railway Air Services Limited and Jersey Airways Limited.

On Saturday morning, with Mr. Sherrington again in the chair, Mr. E. J. Missenden, Docks and Marine Manager, Southern Railway, delivered a paper on Southampton Docks. As a preface to his description of the activities and organisation of the port, he traced the history of Southampton as a trading centre from the time of the early Saxon settlement at Hamtun in 495 up to 1892, when the London & South Western Railway purchased the docks from the Southampton Dock Company. Mr. Missenden then showed that owing to the foresight and enterprise displayed by the Southern Railway after the amalgamation in 1922, the port had progressed with exceptional rapidity. It was with a certain degree of pride that the Southern Railway could state that in 1935 Southampton handled 41 per cent. of the total ocean-going passenger traffic of this country. The development was indicated by the totals of passengers (excluding troops):—

Year	Inward	Outward	Total
1913 ...	178,158	200,759	378,917
1920 ...	193,471	223,650	417,121
1925 ...	202,354	243,867	446,221
1930 ...	259,125	285,321	544,446
1935 ...	260,547	276,808	537,355

The growth of Southampton's cargo traffic had also been most marked, as shown by the following table:—

Year	Import (Tons)	Export (Tons)	Total (Tons)
1875 ...	206,994	130,475	337,469
1885 ...	206,281	155,770	376,210
1895 ...	369,263	294,263	663,526
1905 ...	581,255	392,719	973,974
1915 ...	169,395	56,111	225,416
1925 ...	626,554	496,759	1,123,313
1935 ...	648,443	399,560	1,048,003

Mr. Missenden summarised these facts by showing the advance which had been made in the number of ships and tonnage entering the port, by means of the following table:—

Year	No. of vessels entering	Net tonnage entering	Gross tonnage entering
1875 ...	2,321	1,145,582	1,818,508
1885 ...	2,447	1,211,995	2,032,736
1895 ...	3,119	2,127,858	4,093,583
1905 ...	3,139	2,789,510	5,551,555
1915 ...	4,438	7,515,898	12,826,281
1925 ...	3,261	6,792,612	13,071,266
1935 ...	3,114	9,738,323	17,991,539

At the conclusion a number of questions and arguments were put, to which Mr. Missenden replied. Before adjourning the meeting, Mr. Sherrington called upon Mr. F. E. Wentworth-Shields, Docks Engineer, Southern Railway, who was responsible for the construction of the new docks. He spoke briefly of the problems that had been successfully overcome in the construction of the new quays. After lunch inspections were made of the interiors of the *Queen Mary*, and the Southern Railway cross-Channel ferry steamer, *Twickenham Ferry*. The latter vessel was described in THE RAILWAY GAZETTE for March 23, 1934. Tea was then taken at the invitation of the railway company on board the Southern Railway Channel Islands service steamer, the ss. *Dinard*. Among those who welcomed the members of the association were Mr. R. P. Biddle, Assistant Docks and Marine Manager, and Mr. Pelly, Assistant to the Docks and Marine Manager.

Sunday was spent in making a whole day motor tour in coaches provided by the Hants and Dorset Motor Services Limited. The places visited included Cadnam, the New Forest, Ringwood, Wimborne, Milton Abbas, Tolpuddle, Wareham, Corfe Castle, Poole, Bournemouth and Lyndhurst. On Monday morning Mr. A. Dudley, of the Union Castle Mail Steamship Company, presented the last paper of the convention. This dealt with "Shipping and Navigation" and once again a lively discussion ensued. In the afternoon the party left Southampton by train for Portsmouth and Southsea, where an inspection was made of the Royal Naval Dockyard. After tea the party entrained for Waterloo.

Once again the association was indebted to the wonderful organising capacity of its Secretary, Mr. A. F. Wallis, who, together with Messrs. L. W. Orchard, B. Pearce and H. Bailey, was responsible for all the necessary preparations. The association was also indebted to Mr. G. Ponsonby, of the London School of Economics, for the assistance he so kindly gave in the discussions.

A G.W.R. WINDSOR CASTLE POSTER.—An impression of Windsor Castle as seen from the Thames forms the subject of a new and attractive G.W.R. poster, by Mr. Frank Newbould. The scene is sufficiently familiar for the poster to go untitled, and apart from the G.W.R. monogram in the bottom left-hand corner, it is without letterpress. As a hint to those whose topography is not strong, however, the artist allows the name "Windsor" to appear on the end of a boat house half seen through the trees on the river bank. A punt and a steam launch in the foreground suggest some of the recreations offered to the visitor. The poster conveys all the message that is required with the utmost economy not only in detail, but in colour, largely reduced to masses of green and gold in different shades. We would congratulate the artist on the ingenious manner in which he has tackled the chief problem of this form of art—that of catching the eye and stimulating the imagination of a transitory audience.

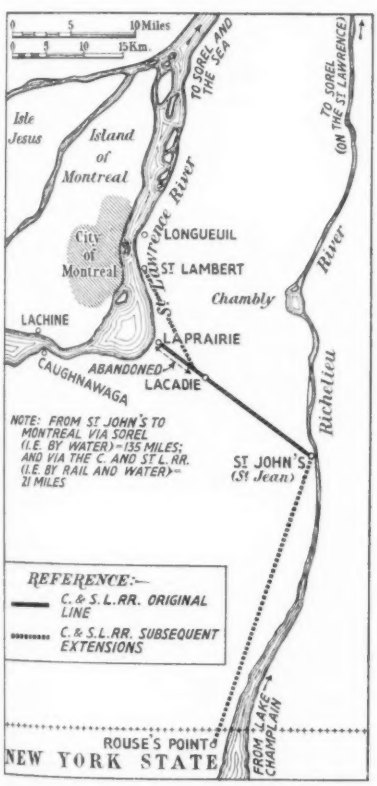
DAVIES & METCALFE LIMITED.—Davies & Metcalfe has been registered as a public company, with a capital of £100,000 in 10s. shares, to acquire the business of engineers and manufacturers of steam injectors now carried on by D. & M. Investments Limited. The directors are Messrs. R. D. Metcalfe, J. C. Metcalfe, L. J. Kastner, and J. A. Rae Smith. The registered office is at Injector Works, Romiley.

Centenary of the First Canadian Railway

(*See editorial note on page* 129)

Last week-end the centenary of opening of the first public railway in Canada—that between Laprairie and St. John's—was celebrated. A special train left Bonaventure station, Montreal, at 1 p.m. on Saturday for St. John's (St. Jean), where one ceremony was held; and on Sunday, at 9.5 a.m. another special train left the same Montreal station for Laprairie. On Sunday (July 19) Mr. Mackenzie King, the Prime Minister of Canada, and Mr. Howe, the Minister of Transport, sent congratulatory messages to officials of the Canadian National Railways, in whose system this early line is now merged.

Many of the early railways of the United States indicated by their titles that their objects were to join two navigable waterways—for example, the Delaware & Hudson—and the first Canadian was also in this category. It was formed under the title of the Champlain & St. Lawrence Railroad Company, and was planned to link St. John's with Laprairie. A Bill for this purpose was passed by the Province of Lower Canada in December, 1831, and when this received the Royal Assent the company was incorporated on February 25, 1832. The line, about 14 miles long, was formally opened for public traffic on July 21, 1836, by Lord Gosford, then Governor-General of Canada. From the beginning locomotive traction was used, and the first three engines were the *Dorchester*, *Laprairie*, and *Jason C. Pierce*. The first-named was ordered in September, 1835, from Robert Stephenson & Co. of Newcastle-on-Tyne. The firm's records show that the order was booked on October 26, 1835, and the engine completed on March 1, 1836; it was locomotive No. 127 made by the firm. The original track consisted of timber rails on which were spiked flat iron bars about 2½ in. wide and ⅜ in. thick. This form of permanent way, which was not unusual in early U.S.A. practice, lasted until about 1851, when extensions of the original line necessitated relaying.



Sketch map of the Champlain & St. Lawrence Railroad

This pioneer railway of 1836 soon provided the impetus for further rail construction in several directions. In 1847 a line known as the St. Lawrence & Atlantic was built from Longueuil (on the south shore of the St. Lawrence nearly opposite Montreal), eastward to St. Hyacinthe; by 1851 it had reached Richmond; in 1852 Sherbrooke, Que.; and in 1853 it was extended to Island Pond, Vermont. Here it connected with the Atlantic & St. Lawrence Railroad, completed in 1853, between Island Pond and Portland, Maine; this line connecting with the Boston & Maine Railroad. On November 19, 1847, the Montreal and Lachine line was opened, and the Lake St. Louis & Province Line Railroad from Caughnawaga (opposite Lachine) to Mooers Junction, N.Y. was completed in 1852. By using a ferry across the St. Lawrence River, this made a new connection between Montreal and the United States railroads to the south. In 1852 the Montreal & Lachine and the Lake St. Louis & Province Line Railroads were merged as the Montreal & New York.

After a few years of working, the Champlain & St. Lawrence Railroad decided upon extensions both north and south. The southern extension, from St. John's to Rouse's Point, was completed first, and on August 16, 1851, the first passenger train ran through from Laprairie. The northern extension was from a point near Lacadie to St. Lambert; it was opened on January 14, 1852, and the original section between Lacadie and Laprairie was abandoned.

Following a period of competition for the through trade between Montreal and New York, the original Champlain & St. Lawrence and the newer Montreal & New York companies were amalgamated by Act of May 27, 1857, as the Montreal & Champlain Railroad. A separate company, chartered under the laws of the State of New York on February 26, 1851, to own the 1·21 miles of track south of the international boundary to Rouse's Point, N.Y., however, retained its original title of the Champlain & St. Lawrence Railroad Company, and still exists as a unit of the Canadian National system.

The Montreal & Champlain system passed into the hands of the Grand Trunk Railway in 1863 on lease, and in 1873 by complete ownership. The Grand Trunk Railway Company of Canada had been incorporated in 1852, with the primary object of forming a railway connection between the ports of Quebec, Montreal, and the Great Lakes. Lines were constructed from these important points in Quebec westward through the province of Ontario to Sarnia at the international border, with branches, built and acquired, afterwards radiating in all directions. By 1873 the Grand Trunk had absorbed all the railway lines included in the earlier period of railway building centring around Montreal and points to the south and east. The Grand Trunk Railway was, in turn, absorbed on January 30, 1923, by the Canadian National Railways, which thereby inherited these pioneer lines.

The Champlain & St. Lawrence Railroad Company,

IN connection with the Steamer *Princess Victoria* is now prepared to convey Passengers between MONTREAL and ST. JOHNS as follows :—

STEAMER. *From Montreal, precisely*	CARS. *From Laprairie.*
8 o'clock, A. M.	9 o'clock, A. M.
2 o'clock, P. M.	
5 o'clock, P. M.	6 o'clock, P. M.

CARS. *From St. Johns.*	STEAMER. *From Laprairie.*
	6 o'clock, A. M.
7 o'clock, A. M.	9 o'clock, A. M.
2 o'clock, P. M.	4 o'clock, P. M.

ON SUNDAYS.

The Steamer and Cars will leave as follows :—

STEAMER *From Montreal, precisely*	CARS *From St Johns.*
10 o'clock, A. M.	7 o'clock, A. M.
5½ o'clock, P. M.	3 o'clock, P. M.

And from LAPRAIRIE, the Steamer will leave on arrival of the Cars, and the Cars, on arrival of the Steamer.

FARE.

To and from St. Johns the same day...7s.-6d.
To or from St. Johns only.....5s.

Children half price.

August 6, 1836.

Early timetable, reproduced from "The Gazette" of Montreal dated August 16, 1836

MANCHESTER SHIP CANAL EARNINGS.—The traffic receipts of the Manchester Ship Canal Company for the half-year ended June 30, 1936, amounted to £650,965, as compared with £625,444 (adjusted) for the corresponding period of last year, an increase of £25,521. The net revenue of the whole undertaking for the half-year (after providing for interest and fixed charges) was £6,780 more than for the corresponding half-year in 1935.

MINISTRY OF TRANSPORT ACCIDENT REPORT

Barkston, L.N.E.R.: January 19, 1936

Two light engines from Peterborough to York travelling at 45 m.p.h. or over collided at about 6.16 a.m. with a ballast train, running at 20 m.p.h., conveying a relaying gang from Grantham to Newark: the rear brake van and the next five wagons were completely demolished. Five of the 12 men in the van were killed, three succumbed later and the others were seriously injured. The engines travelled another 300 yd.; the enginemen escaped with trifling injuries. Permanent way was damaged for about 200 yd. Medical assistance reached the spot without undue delay and valuable aid was rendered by the wives of railwaymen living near. Lieut.-Colonel E. Woodhouse conducted the inquiry.

Particulars of track circuiting and other apparatus are given on the diagram. Peascliffe box is closed from 6.0 a.m. on Sunday until 6.0 a.m. on Monday as a rule, but was open on this occasion as freight traffic was unusually heavy on account of delays caused by severe weather in the North the previous week. There was no material difference in the clocks concerned, discrepancy in times recorded in no case exceeding one minute.

The ballast train was following some mineral empties and was accepted by Peascliffe at 6.2 a.m. and stopped at the down home there as the section ahead was not clear. The signalman told the enginemen the headlight was out and this was rectified. The train was accepted at 6.8 a.m., as recorded

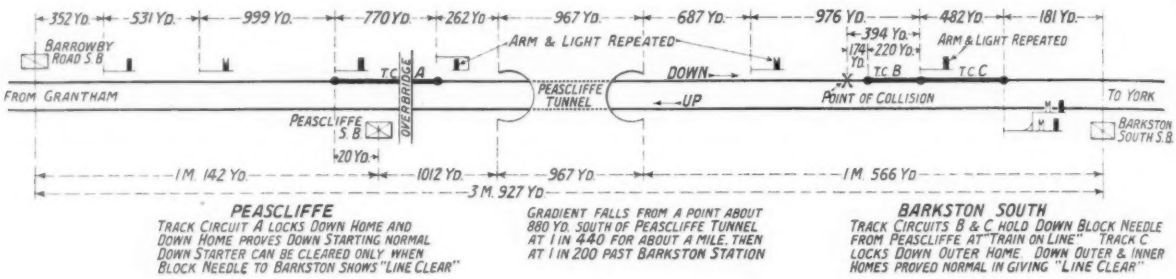

352 YD.
531 YD.
999 YD.
770 YD.
262 YD.
967 YD.
687 YD.
976 YD.
482 YD.
181 YD.
394 YD.
174 YD.
220 YD.
BARROWBY ROAD S.B.
ARM & LIGHT REPEATED
ARM & LIGHT REPEATED
TC A
P
DOWN
UP
PEASCLIFFE TUNNEL
TC B
TC C
FROM GRANTHAM
POINT OF COLLISION
TO YORK
PEASCLIFFE S.B.
OVERBRIDGE
BARKSTON SOUTH S.B.
220 YD.
1M. 142 YD.
1012 YD.
967 YD.
1M. 566 YD.
3M. 927 YD.
PEASCLIFFE
TRACK CIRCUIT A LOCKS DOWN HOME AND DOWN HOME PROVES DOWN STARTING NORMAL DOWN STARTER CAN BE CLEARED ONLY WHEN BLOCK NEEDLE TO BARKSTON SHOWS "LINE CLEAR"
GRADIENT FALLS FROM A POINT ABOUT 880 YD. SOUTH OF PEASCLIFFE TUNNEL AT 1 IN 440 FOR ABOUT A MILE, THEN AT 1 IN 200 PAST BARKSTON STATION
BARKSTON SOUTH
TRACK CIRCUITS B & C HOLD DOWN BLOCK NEEDLE FROM PEASCLIFFE AT "TRAIN ON LINE" TRACK C LOCKS DOWN OUTER HOME. DOWN OUTER & INNER HOMES PROVED NORMAL IN GIVING "LINE CLEAR"

Diagram showing point of collision and section of line concerned, with signal boxes, signals, and track circuits and distances between them

The ballast train was drawn by an 0-6-0 tender engine and had 30 wagons, with a brake van at each end; only the leading six wagons were loaded. After the collision it ran on to Hougham, about 2 miles north of Barkston, a wagon being derailed on the way and another while the train was being shunted into a siding there.

The light engines were both of the former N.E.R. 4-4-2 type with 6 wheeled tender, each weighing 125 tons 17 cwt. with full tender, and having steam brake controlled by vacuum on all except the bogie wheels; brake ratio is about 51 per cent.

The morning was fine and very dark: there was a hard frost with a little snow on the ground, and some mist or haze, visibility varying from point to point.

The accompanying diagram shows the lines, signal boxes and signals concerned, with distances between them. North of the Peascliffe tunnel the line is in a 25 ft. cutting as far as Barkston station, with a gentle curve to the left at its north end, but the collision occurred in the straight portion. The height of the signals on the down side varies between 18 and 21 ft., but the Barkston South inner home, on the up side, is higher. The view of Peascliffe down starting signal is restricted to about 250 yd. by an overbridge, but the others can be seen much further.

at Peascliffe, when "Train entering section" was also sent for it, and "Train out of section" was returned to Barrowby Road at 6.10 a.m.; the light engines were then accepted. They were signalled in section from there at 6.13 a.m. A minute later Peascliffe sent "Train running away" to Barkston South and telephoned saying the engines had run past all signals at speed. At that time the ballast train had not reached Barkston, where men were waiting to join it. Signalman J. R. Wright at Barkston South lowered his outer and inner homes, when the ballast train was accepted by Hougham, the next box open, at 6.10 a.m. but not his distant, because it had to stop at Barkston. On receipt of the "Train running away" signal and telephone message he did what he could to avert the collision by sending another signalman to meet the ballast train with a hand lamp and detonators, instructing him to signal to the driver not to stop, and by shouting to the men on the platform to tell the driver to keep moving. The train had not then reached track circuit B (see plan), but he put the outer home to danger as soon as track circuit C was occupied. When the train passed at 6.18 a.m. he saw it was incomplete and sent "Stop and Examine" to Hougham. He was certain he had not lowered the distant signal, not even in South distant shortly after leaving the tunnel. It showed a good yellow light with no green visible. Robinson corroborated this and estimated visibility north of the tunnel at about a quarter of a mile.

The tail lamp and sidelights of the ballast train had been prepared and lighted by Robinson before leaving Grantham. He said the tail lamp was a very good one, which he frequently used, and was burning brightly when he put it in position; he did not place the sidelights, but left them to be fixed by Sub-Ganger Harris, acting as guard. It is not certain whether they were put in position, as Harris was killed, and the signalmen at Barrowby Road and Peascliffe could not recollect whether they saw them, but said the tail lamp was giving a good light. The enginemen were unable to remember whether they had seen them during the journey. Mr. Grinling, District Engineer, said Harris was a most reliable man and he thought it improbable that he would have omitted to fix the sidelights.

Contradictory evidence was given regarding the indications of the Peascliffe signals when the light engines passed them. Signalman H. W. Hebblethwaite relieved Signalman G. C. Ward at Peascliffe at 6.0 a.m. when the empty mineral train was approaching. Ward left the box about the time it was

passing and Hebblethwaite dealt with the signalling of the ballast train. He stated positively that he restored his down distant behind the mineral train and did not lower it again during his turn of duty. It was too misty to see the backlight at 1,019 yd. but he judged from the feel of the lever that the signal responded correctly. When the mist disappeared, though the frost continued, the arm was not drooping. He was also positive he put his home and starting signals to danger behind the ballast train, before accepting the light engines: the repeater showed that the starting signal had obeyed the lever. Shortly after receiving "Train entering section" for the light engines Hebblethwaite heard them approaching, but did not realise they were not going to stop until they were practically opposite the box. All his signals were "on" when they passed. After sending "Train running away" and telephoning to Barkston he told Signalman Soons at Barrowby Road what had happened. Shortly afterwards he heard the collision and reported it to Soons, in order that he might inform King's Cross Control Office. Soons confirmed these messages and said that Hebblethwaite answered all block signals promptly.

The light engines left New England (Peterborough) at 5.35 a.m. and ran thence without stopping, the only check being at Grantham South distant. The leading one was driven by Passed-Fireman (Acting Driver) D. Ward, who had driven a special fish train from York, reaching Peterborough at 3.38 a.m. He said he was well acquainted with the line as far south as Peterborough and had driven over it 3 or 4 days prior to the accident. He was controlling the steam brake on both engines with the vacuum handle. He said he was looking out on the fireman's (left) side and had his head out of the side window practically continuously. It was bitterly cold and the glass wind deflector was covered with ice, which he tried unsuccessfully to wipe away; he thus had to lean out further than usual and the wind made his eyes water, but he was certain he observed all signals correctly. He maintained that the three Peascliffe signals were "off" and showing full green lights. He had not misread Barrowby Road starting for Peascliffe distant and denied that he was expecting to find Peascliffe closed. He estimated visibility there at 50 or 60 yd. North of the tunnel he thought it extended to 100 yd. He was on the right side of his engine in the tunnel but crossed again to observe Barkston South distant, which he asserted was unmistakably off, but although he continued to look out he saw nothing of the tail lamp or sidelights of the ballast train. He estimated his speed as 40 m.p.h. when the collision occurred, and suggested that his sight might have been temporarily affected by the weather. He had not looked into the fire, nor warmed his hands or face at it. His sight and colour vision were normal on May 17, 1935.

Ward's fireman, H. Calvert, did not see any of the signals concerned, and confirmed that Ward was looking out for them from the left side up to the tunnel, but was practically certain he was not on that side north of it. The driver of the second engine, G. Smith, said steam prevented him from seeing any of the Peascliffe signals, but as both engines were running without steam after the tunnel he was able to see Barkston South distant and was certain it was "off." His fireman said he saw no signals north of Grantham.

Signalman G. C. Ward left Peascliffe box at about 6.2 a.m. and walked southwards along the line. The ballast train passed him five minutes later and the light engines when he was about 100 yd. south of Peascliffe distant. It struck him that they were running very fast and he looked to see if the signal had been lowered. He could see its light clearly, a full yellow one with no green visible.

Inspecting Officer's Conclusions

The evidence is contradictory regarding the indications of the Peascliffe signals and Barkston South distant when the engines passed them. Colonel Woodhouse accepts the statements of the men on the ballast train engine that the latter signal was "on" when they passed it. The assertions regarding its indication a minute or so later are hardly relevant. The engines should not have reached it with the ballast train in section and Signalman Wright, if he had not lowered the signal when the ballast train was accepted by Hougham, could not have been criticised had he done so in an endeavour to avoid checking the ballast train. Colonel Woodhouse considers that the independent testimony of Signalman Ward, supported by Signalman Hebbelthwaite, concerning the indication given by Peascliffe distant may be relied on and that Driver Ward's assertion that all the Peascliffe signals were off is disproved. But with the arrangements provided there remains the possibility that the home and starting were incorrectly "off." If so, Hebbelthwaite must have failed to replace them behind the ballast train, but having regard to the evidence of other witnesses concerning the way he was doing his work and his prompt action in several respects Colonel Woodhouse considers such a failure on that signalman's part extremely unlikely.

Driver Ward's statement regarding Peascliffe distant was proved to be erroneous and his fireman's evidence threw some doubt on his actions after leaving the tunnel. It is difficult to understand why he saw no tail lamp or sidelights if he was looking out as he described. Colonel Woodhouse concludes that Signalman Hebbelthwaite's evidence should be accepted in preference to Driver Ward's, who might perhaps have been slightly dazed by the cold and by looking out under conditions of poor visibility, and have mistaken the green light of Barrowby Road starting signal for Peascliffe distant, but it is difficult to account for his failure to notice the tail lights of the ballast train. Responsibility for the accident must be borne by him. His past record is a good one.

Remarks

This accident being caused, in Colonel Woodhouse's opinion, by inattention to signals, automatic train control would in all probability have prevented it. The line from Grantham to Barkston South, which carries fairly heavy traffic, is shortly to have continuous track circuits and colour light signals.

PARLIAMENTARY NOTES

Progress of Railway Bills

The G.W.R. (Additional Powers) Bill was read a third time, with the amendments, and passed by the House of Lords on July 16, and returned to the Commons. The Lords' amendments were considered and agreed to by the House of Commons on July 20, and the Bill now awaits the Royal Assent. The L.N.E.R. (General Powers) Bill, and the L.N.E.R. (London Transport) Bill were read a third time, with the amendments, and passed by the House of Lords on July 20, and returned to the Commons. The London Passenger Transport Board Bill was read a third time, with the amendments, in the House of Lords on July 21. Further amendments were made, and the Bill was passed, and returned to the Commons. The Manchester Ship Canal (Lords) Bill was read a second time and committed in the House of Commons on July 20. The Bill gives the company power to construct railways; to extend the time limited for construction of certain authorised railways and to abandon the Manchester & Salford Junction Canal. Petitions have been deposited by the Lancashire County Council, the Stretford Corporation, the Manchester Corporation, and the Urmston Urban District Council against the Bill, which is due to come on July 27 before a Select Committee presided over by Sir John Ganzoni.

OLYMPIC GAMES CONTESTANT.—Major A. D. Pearce, Manager of the Birmingham branch of B.E.N. Patents Limited, has been selected as a member of the British Olympic fencing team taking part in the Berlin games in August. He was British Amateur Foil Champion in 1927, and has represented Great Britain in international events upon nine occasions.

XUM

Railway Staff and Labour Matters

We recorded in last week's issue (page 120) the first day's proceedings of the Railway Staff National Tribunal, which met on Wednesday, July 15, to hear the wage claims of the National Union of Railwaymen and the Railway Clerks' Association.

On Thursday, July 16, Sir Arthur Salter, K.C.B., D.C.L., again presided, when the case of the Railway Clerks' Association was continued by Mr. W. Stott, General Secretary, who argued that the fact that some railway stockholders had received little or nothing in recent years was no reason why the workers should assist them by giving up part of their earnings. Mr. Stott put forward suggestions for meeting the difficulty. For instance, he said, that if the 5 per cent. stockholders gave up one-fifth of their interest or dividends, that would amount to £1,826,000, and he claimed that the railway problem would never be completely solved until the railways and all forms of transport were co-ordinated with public ownership and control. Mr. Stott concluded his case by asking the Tribunal to decide that the deduction of 2½ per cent. from the earnings of salaried staff should be discontinued.

The Railway Companies' Case

Mr. Kenelm Kerr opened the case of the railway companies in opposition to the union claims, the annual cost of which was £2,970,282, the total number of staff involved being 399,770. These figures relate to the four main-line companies, although the decision of the tribunal would apply to the staff of the Railway Clearing House and certain joint lines.

Mr. Kerr submitted that, having regard to the circumstances in which relief was granted to the companies by the National Wages Board in March, 1931, and the present economic position of the railway industry, the claims were not justified. The discontinuance of the residue of the relief could not be justified until the economic position of the companies was better than that obtaining at the time when the relief was granted. The companies did not agree with the submission of Mr. Marchbank that the continuation of the deductions and variations in conditions imposed undue hardship on the staff. Mr. Kerr argued that neither the net revenue nor the dividend position was such as to justify the granting of the claims. Referring to the increase in railway traffic receipts during the early months of 1936 mentioned by Mr. Marchbank, Mr. Kerr pointed out that this increase was in relation to a period in 1935 when receipts were at a low level. Gross traffic receipts only partially reflected the position. Net revenue was the proper measure of the companies' economic position.

Proceeding, Mr. Kerr said that the payment of salaries and wages was admittedly a first charge on the companies' current revenues, of which the salaries and wages bill already absorbed a very high proportion. The net revenue position was not such as to justify the granting of the claims. The partial discontinuance of the percentage deduction was an act of goodwill on the part of the companies seeing that on the facts no concession was justified. The companies had been compelled, by reason of their economic position, to take all practicable steps to reduce their working expenses, but they used their best endeavours to minimise the effects of such economies on the staff. The companies asked that they should be permitted to retain the residue of certain relief which had already been granted to them, as until the cancellation was justified, the relief given by the decision of the National Wages Board ought to remain. The decision of the board was based on the inadequacy of the net revenue and the excessive burden of labour costs. In the railway industry there had been a partial restoration of the cut, but there had been no cessation of the much heavier loss which had to be borne by the other partners—the stockholders.

Net Revenue the Real Test

Mr. Kerr did not agree that relief afforded to the companies on labour costs was temporary or intended for a limited period only. The relief was dependent on proof of the low level of the fortunes of the railway companies, and the test was the figure of net revenue. The relief was not for a period, but for a purpose, and that purpose had not been fulfilled. He submitted that the relief was "conditional" upon the fall of the net revenue from 1929 to 1930, and the resultant low level of net revenue in 1930. The net revenue for 1935 was 12·7 per cent. below the level of 1930. The relief granted by the National Wages Board under Decision No. 119 was not in any way linked with the National Emergency of 1931. The companies' claim had been discussed with the unions in November, 1930, and had been referred to the National Wages Board in December, 1930. The decision was issued on March 5, 1931, but the state of "national alarm," to which Mr. Marchbank had made reference, did not arise until August of that year.

Replying to arguments of Mr. Marchbank, Mr. Kerr said that the National Agreements of 1919 and 1920 laid down proper rates for overtime, night duty and Sunday duty, and that these National Agreement conditions were no more sacrosanct than the agreements relating to wages. He agreed the companies had achieved a certain measure of success in combating road competition and attracting traffic back to the railways. The trade depression had been passing away to a certain extent, but the difficulty had been in the heavy industries. The improvement in the state of trade was valuable, but it was slow. It had not reached a stage when the companies could afford to relinquish the residue of the relief that was afforded to them. The companies felt very strongly the need for elasticity in the working of the industry. The National Wages Board declined to give them that elasticity, but reduced the overtime rate, probably because that was regarded as more acceptable to the unions than touching the guaranteed week or day.

Wages and Purchasing Power

The average loss in the conciliation grades from the deduction in earnings was 1s. 8d. a week, and from the variation in conditions 1s. 6d.—making a total average loss of 3s. 2d. a week. The average weekly earnings of these grades in March, 1931, were 65s. 10d. and in March, 1936, allowing for the percentage deductions, 64s. 5d.—a difference of only 1s. 5d. Taking purchasing power, in relation to the fall in the cost of living, there was an excess in earnings, for the same comparative period, of 4d. a week. Whereas at December, 1935, the level of increase of wages rates in industry generally (including railways) was 68 per cent. above pre-war rates, the increase in the average level of railway-men's wage rates was 116 per cent.

The tribunal adjourned about five o'clock on Thursday (July 16) and when it met again at 10.30 on Friday morning (July 17) Mr. Kerr continued his presentation of the case for the railway companies. The following are points from his speech:—

The test of purchasing power, or real wages, demonstrates that Conciliation Staff rates showed a betterment over pre-war of 48 per cent. while Conciliation Staff earnings showed a betterment of 55 per cent. The net revenue in 1935 was £4¾ millions below 1930—£12 millions below 1929 and £18¼ millions below the standard revenue which Parliament considered proper and reasonable remuneration. The National Wages Board accepted the £37¾ millions net revenue of 1930 as proof of the necessity for relief. The Unions accepted the £41 millions net revenue of 1928 and the £42½ millions net revenue of 1927 as justifying voluntary relief. It is useless therefore for the unions to argue that £33 millions net revenue of 1935 (coupled with mere hopes of the future) warrants discontinuance of the relief awarded.

The question of relief in respect of local taxation is part of a problem very complex, very uncertain in results, and one which cannot have effect until an unknown date. That being so, it has no bearing on the present issue. As to the argument of the unions that it is in the national interest to end the deduction in order to increase the purchasing power of the employees, purchasing power is just as valuable in

the hands of the still more numerous stockholders—the bulk of whom are undoubtedly people of modest means.

Labour Costs Outweigh Higher Charges

The increases in labour costs are out of proportion to the increase in traffic charges, viz., 58½ per cent.—merchandise; 25 per cent.—passenger. It is the excessive burden of labour cost which has forced up the traffic charges. This is to the detriment of the competitive position of the railways. The burden of labour cost could not be borne but for good management and drastic economy.

The loss suffered by the staff is far less serious than that suffered by the stockholders. In 1935 the average return on ordinary capital was less than 1 per cent.—a return quite inadequate if the railway industry is to maintain efficiency and continue development. Moreover, large sections of capital have gone for years without any remuneration at all. In 1935, even allowing for some improvement in the position and with the aid of the relief now at issue, no less than £271 millions of capital received no remuneration.

Stockholders More Numerous than Employees

Mr. Kerr had been speaking for nearly six hours when he concluded his speech by urging that in justice to the stockholders, who were much more numerous than the employees and whose loss had been far heavier, the claims of the unions should be rejected. "The real point at issue," he emphasised, "is whether the railway companies should retain the residue of the relief unanimously awarded to them by National Wages Board Decision No. 119. It is the unions who seek to cancel the relief so awarded. It is for the unions to prove their case. The unions have failed to do so."

Mr. Kerr then asked the tribunal to find that, having regard to the present low level of the net revenue of the railway companies, the claims of the unions have not been established.

Reply of the Unions

After a luncheon interval, Mr. Marchbank replied for the National Union of Railwaymen to the case of the railway companies. "We claim," he said, "that the first charge on the industry is adequate wages and salaries, and we do not admit that railwaymen are adequately or properly paid." Commenting on the arguments used by Mr. Kerr in regard to the cost of living, Mr. Marchbank claimed that the data on which the index number was compiled were out of date and bore no relation to economic actualities. He stressed the fact that rent was a tremendous factor in determining whether men on weekly wages had sufficient upon which to live. There were, he declared, at least 73,000 railway employees who received less than 45s. a week and 130,000 men were receiving 50s. a week or less. In reply to an inquiry put by Mr. Kerr, he explained that these figures related to rates of pay, and agreed that earnings would be higher than rates of pay.

Mr. Stott followed to reply to various points which had arisen in the course of Mr. Kerr's case. He dealt particularly with pooling economies and said that, although the employees did not like the consequences of pooling, they made no general complaint. Indeed, he complimented the companies on the way in which they had carried out the undertakings they gave before the Railway Pool Committee.

Following the conclusion of Mr. Stott's case, the tribunal adjourned until Monday, July 20.

Conclusion of Hearing

The tribunal assembled again on Monday, June 20, and the afternoon was devoted to questions. At the outset Sir Arthur Salter, the Chairman, pointed out that there was necessarily no cross-examination during the hearing, and accordingly certain of the questions to be put by himself and members of the tribunal would be directed to bring out points which might have been put by cross-examining counsel. The questions ranged from matters of finance to views on promotion, and at the conclusion of the proceedings the Chairman said that, having now terminated this stage of its work, the tribunal would be in a position to consider the evidence now put before it with a view to arriving at an award. He also said one thing would be clear to everyone, namely, that the tribunal had a good deal of extremely difficult, interesting, and complicated material before it, and necessarily the tribunal would take a little time before issuing its decision.

(*See also editorial note on page* 129)

RAILWAY AND OTHER REPORTS

Southern Railway.—The directors announce that for the half year ended June 30 last, compared with the corresponding period of last year, the receipts from passenger train traffic increased by £111,000, and from goods train traffic by £79,000, but the higher earnings were practically absorbed by an increase in railway working expenditure of £183,000. The net receipts from steamboats, docks, harbours and wharves, hotels, interest, &c., show a decrease of £24,000, and the net revenue for the half year is approximately £17,000 less. The receipts and the expenditure for the half year are both affected by the extra day in leap year. With regard to the rating position, at present the company's payments to the local authorities and the Railway Freight Rebates Fund are still based on the assessments previously ruling, and £125,000 has therefore been deducted on account of estimated overpayments for the half year. The comparative figures for the half year to June, 1935, contain a similar adjustment.

The directors have decided to pay an interim dividend on the preferred ordinary stock of £1 per cent., the same rate as last year. Interim dividends of £2 10s. per cent. on the guaranteed preference and preference stocks, together with the interim dividend of £1 per cent. on the preferred ordinary stock, will be paid (less income tax) on August 13 next. Warrants will be posted on August 12.

Great Northern Railway (Ireland).—After transferring a sum from reserves, the directors have declared an interim dividend of £2 per cent. (less income tax) on the consolidated 4 per cent. guaranteed stock for the year 1936, which will be paid on September 1 next to the proprietors who will be registered at the closing of the transfer books on the 29th instant. The directors regret that the results for the half-year ended June 30, 1936, do not permit of the payment of any interim dividends on the preference and ordinary stocks.

Vickers Limited.—The directors give notice that the following interim dividends for the half-year ended June 30, 1936, will be paid on August 28: 2½ per cent. (less income tax) on the preferred 5 per cent. stock; 2½ per cent. (less income tax) on the 5 per cent. preference stock; 2½ per cent. (free of income tax) on the cumulative preference stock.

Beyer, Peacock & Co. Ltd.—The accounts for 1935 show a loss, after interest charges, of £13,753, against a loss of £17,315 for 1934. The year's loss, together with £1,476 in respect of discount on bills sold, is added to the debit balance carried forward, making it £71,430. There has been a small but definite improvement in the market for locomotives during the year. Many of the countries with which the company has excellent business connections have made considerable economic progress, and there is undoubtedly a growing need for new locomotives on many foreign railways. With the gradual amelioration of conditions of exchange, there should be a steady increase in the volume of orders. The Richard Garrett Engineering Works Limited has continued to make good progress. Profits for the year ended June 30, 1936, more than covered the debit balance on profit and loss account brought in, and the activities of this asset are likely in the near future to prove of considerable value. The plant, machinery and equipment of the factories at Gorton and Leiston have been adequately maintained, and are ready for the increased production which will be required in the near future.

HENRY BERRY & CO.'S NEW LONDON OFFICE.—After August 10, the London office of Henry Berry & Co. Ltd. will be at Shell-Mex House, Victoria Embankment, W.C.2.

XUM

NOTES AND NEWS

Road Transport Wages. — The Minister of Labour has announced that an independent committee is to be set up to examine the whole subject of the wages and conditions of the road transport industry.

The Salta-Antofagasta Railway.—According to advices from Santiago (Chile), the international railway from Antofagasta to Salta (Argentina) has now been completed from Augusta Victoria to Avarillas, a distance of 55 km.

L.M.S.R. Engines Named after Irish Provinces.—Four Jubilee class express locomotives to be built at Crewe works towards the end of this year are to be named after the four Irish provinces—Ulster, Munster, Leinster, and Connaught. The numbers will be 5739 to 5742, in the order of the names as stated.

Railway Concession to Friends of the Blind.—All the British railways have agreed with the National Institute for the Blind to allow friends visiting inmates at homes and schools of the institute to travel at reduced rates; a return journey may be made at single fare, and first-class travel is 50 per cent. above the third-class rate.

New Goods Fleet for Ulster Road Transport.—The Northern Ireland Road Transport Board has been operating, since June 3, the freight services of 54 hauliers around the Ards district. The board has recently taken delivery of 24 Leyland goods vehicles. The chassis, forward-controlled Beaver Sixes with 16 ft. wheelbases and 8·6 litre oil engines, are the forerunners of orders for 40 chassis placed by the board with Leyland Motors Limited. The balance is to follow at the rate of three chassis a week.

Kingsway Tramway Subway Alteration.—Part of the Kingsway tramway subway of the London Passenger Transport Board is to be re-aligned before work can be begun on the foundations of the northern abutment of the new Waterloo Bridge; the new entrance will be midway between the two supporting members of the Embankment span of the new bridge. On July 7, the London County Council placed a contract for this work, valued at £70,000, with Sir William Arrol & Co. Ltd., the firm responsible for the demolition of the old Waterloo Bridge.

Improvements at Crewe, L.M.S.R.—As mentioned in an editorial note on page 130, the L.M.S.R. is carrying out resignalling at Crewe to allow passenger trains to avoid the station by using routes hitherto available only for goods traffic. In addition, three new signal boxes have been provided—at Wardle, Brassey, and Nant Hall—to decrease the interval between trains on the Crewe-Chester-Holyhead main line. The improvements at Rhyl, mentioned in the note already referred to, have also involved additional signalling, including the adaptation of the down passenger loop platform to act as a starting point for up trains.

Future of Private Railways in Sweden.—The Swedish Minister of Communications has been authorised by the Government to appoint a committee of seven to investigate the possibilities of bringing all private railways in Sweden under the management of the State Railways, says a message from Stockholm to Reuters Trade Service.

The Mowatt Challenge Cup Competition, 1936.—The final cricket match for the challenge cup presented by the late Rt. Hon. Sir Francis Mowatt, G.C.B., was played on the L.N.E.R. (Great Northern Section) Athletic Ground at Gordon Hill on July 16, when the Mechanical Engineer's team from Doncaster beat the Locomotive Running Department's team by 119 runs for 9 wickets to 117 runs.

Colvilles Limited.—At a meeting of Colvilles Limited held in Glasgow on July 17, resolutions were carried enabling the company to acquire the whole ordinary share capital in the Lanarkshire Steel Company. During the course of his speech the Chairman announced that the board of Colvilles Limited had invited Mr. Harry Cunningham, Chairman of Sir William Arrol & Co. Ltd., to join the board of the Lanarkshire Steel Company. Mr. Cunningham is also Chairman of the Bridge and Constructional Ironworks Association and Chairman-elect of the British Constructional Steelwork Association.

B.E.N. Patents and Broom & Wade.—With a view to enlarging the scope of the respective businesses, a merger of interests has been concluded between Broom & Wade Limited, of High Wycombe, and B.E.N. Patents Limited, of Park Royal, London. Broom & Wade manufactures a complete range of portable and stationary air compressors and pneumatic tools, whilst the products of B.E.N. Patents include a range of small air compressors, paint spray, and garage equipment. Apart from a further interchange of directors, the management and affairs of the two companies will continue as before.

The South Wales Trade Recovery and Expansion Committee.—Following the conference with South Wales and Monmouthshire industrialists held at Paddington on July 8 under the presidency of Sir Robert Horne (see page 62 of our July 10 issue), a preliminary meeting of the committee then formed took place at Paddington on July 17, also under the presidency of Sir Robert. The committee has adopted the title of the South Wales Trade Recovery and Expansion Committee. The first members include Sir Robert Horne, Lord Portal, Sir Evan Williams, Sir David Llewellyn, Sir John Beynon, Sir Charles Wright, Mr. E. L. Hann, Mr. E. H. Watts, and Mr. A. L. Horner. Various sub-committees have been formed to deal with different aspects of the problem of restoring activity to the area. Each committee will investigate its own subject, and make recommendations to a further meeting of the full committee at an early date.

Bristol Tramway Changes.—On Tuesday, the Bristol City Council agreed to the proposal to buy the local tramways undertaking for £1,125,000 in 3 per cent. Corporation stock, with a view to replacing trams with buses within two years. The present owner, the Bristol Tramways & Carriage Co. Ltd., is a subsidiary of the Western National Omnibus Co. Ltd., and, therefore, an associate of the G.W.R. The intention is for the Bristol Corporation to establish a joint committee with the company to own the urban bus services which would be managed by the company on behalf of the joint committee. The Bristol Tramways & Carriage Co. Ltd. recently enlarged its activities by acquiring the bus services of Bence Motor Services Limited; the latter company went into liquidation on July 1.

The Engineer and Railway Staff Corps Annual Dinner.—The annual dinner of the Engineer and Railway Staff Corps, R.E. (T.A.), was held on July 20, at the May Fair Hotel, London, with Sir Herbert A. Walker, Colonel Commanding, in the chair. Among those present were:—

Field-Marshal Lord Milne, Field-Marshal Sir Cyril Deverell, General Sir Edmund Ironside, General Sir Walter Kirke, Lt.-Gen. Sir Reginald May, Lt.-Gen. Sir Hugh Elles, Lt.-Gen. Hon. Sir Richard M. Stuart-Wortley, Major-Gen. W. E. Venning, Brig. H. B. North, Col. W. G. Tyrrell, Lt.-Col. A. H. L. Mount, and Sir Herbert Creedy. Colonels Sir Ralph Wedgwood, Sir Cyril Kirkpatrick, Sir James Milne, Sir Josiah Stamp, Sir George Humphreys, Sir Robert Elliott-Cooper, Sir Henry Fowler, A. Newlands. Lt.-Cols. A. J. Barry, E. C. Cox, C. J. Brown, R. E. L. Maunsell, Sir Herbert Gresley, H. H. G. Mitchell, Sir David Owen, G. S. Szlumper, G. Ellson, R. Carpmael T. P. Frank, C. R. Byrom, A. R. Cooper. Majors C. J. Selway, Sir John Eaglesome, F. W. Wentworth-Sheilds, A. Binns, K. T. Lomas, H. F. M. Beames, R. F. Hindmarsh, A. W. Donaldson, E. J. Missenden, H. Firth, D. E. Cameron, S. H. Fisher, W. H. S. Tripp, H. A. Watson, and the Hon. Sec. R. A. Bacon.

Road Scheme for Manifold Light Railway Track.—Some weeks ago the Cheadle Council decided to urge the Staffordshire County Council to buy the track of the Leek & Manifold Light Railway and convert it into a road for six or seven miles to Redhurst crossing, where it would join a road running from Hulme End down the length of the valley. The L.M.S.R., it was explained, intended to sell the railway with a view to the removal of the track and bridges. The proposal brought forth protests from ramblers and others anxious to preserve the rural amenities of the valley, and the Leek Urban Council unanimously decided to urge the Staffordshire County Council to buy the disused line and convert it into a footpath for those wishing to visit the valley and Dovedale. The council then vetoed

a proposal asking the county council to construct a motor road along the railway, but a fortnight later decided to support the motor road scheme.

Trial follows Trans-Siberian Railway Collision.—Thirteen persons were tried at Chita, Siberia, for responsibility for a collision at Karymskaya on June 22, when 51 persons were killed and 52 injured. The collision resulted from a train being allowed to leave Karymskaya before the line was clear, and colliding in rear with a preceding train. The stationmaster was sentenced to death, and eight other employees to imprisonment for from three to ten years. It is stated that 86 accidents have already occurred this year at Karymskaya.

New Richmond Station, Southern Railway.—The Southern Railway is spending £95,000 on extensive alterations and improvements to Richmond station, which, when completed, will be one of the most modern stations in the south and will comprise station offices three-storeys high, with a row of shops adjoining of similar design. Both the up and down platforms are being lengthened to 600 ft., and the platforms serving the District Line trains also extended. There will be a new footbridge connecting all platforms. A new feature is the provision of a car park on the north side of the station, to accommodate 45 cars. The scheme also entails re-modelling the goods yard and building a new goods shed, as well as widening the bridge over Kew Road.

Road Accidents.—The Ministry of Transport return for the week ended July 18 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents		Injured	
England ...	132	(117)	4,520	(4,572)
Wales	6	(2)	209	(211)
Scotland ...	16	(4)	495	(430)
	154	(123)	5,224	(5,213)

The total fatalities for the previous week were 110, compared with 126 for the corresponding period of last year.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 29th Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,917 mls.)	£	£	£	£	£	£
Passenger-train traffic...	679,000	615,000	+ 64,000	13,306,000	13,200,000	+ 106,000
Merchandise, &c. ...	473,000	426,000	+ 47,000	13,706,000	12,927,000	+ 779,000
Coal and coke ...	214,000	166,000	+ 48,000	7,033,000	6,705,000	+ 328,000
Goods-train traffic ...	687,000	592,000	+ 95,000	20,739,000	19,632,000	+1,107,000
Total receipts	1,366,000	1,207,000	+159,000	34,045,000	32,832,000	+1,213,000
L.N.E.R. (6,332 mls.)						
Passenger-train traffic...	438,000	417,000	+ 21,000	8,645,000	8,612,000	+ 33,000
Merchandise, &c. ...	328,000	305,000	+ 23,000	9,297,000	8,955,000	+ 342,000
Coal and coke ...	214,000	180,000	+ 34,000	6,751,000	6,434,000	+ 317,000
Goods-train traffic ...	542,000	485,000	+ 57,000	16,048,000	15,389,000	+ 659,000
Total receipts	980,000	902,000	+ 78,000	24,693,000	24,001,000	+ 692,000
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	267,000	267,000	—	5,518,000	5,502,000	+ 16,000
Merchandise, &c. ...	194,000	188,000	+ 6,000	5,435,000	5,226,000	+ 209,000
Coal and coke ...	97,000	92,000	+ 5,000	2,926,000	2,875,000	+ 51,000
Goods-train traffic ...	291,000	280,000	+ 11,000	8,361,000	8,101,000	+ 260,000
Total receipts	558,000	547,000	+ 11,000	13,879,000	13,603,000	+ 276,000
S.R. (2,154 mls.)						
Passenger-train traffic...	376,000	377,000	— 1,000	8,258,000	8,216,000	+ 42,000
Merchandise, &c. ...	64,500	64,000	+ 500	1,775,000	1,764,500	+ 10,500
Coal and coke ...	27,500	26,000	+ 1,500	915,000	859,500	+ 55,500
Goods-train traffic ...	92,000	90,000	+ 2,000	2,690,000	2,624,000	+ 66,000
Total receipts	468,000	467,000	+ 1,000	10,948,000	10,840,000	+ 108,000
Liverpool Overhead (6¼ mls.)	1,261	1,210	+ 51	33,673	33,487	+ 186
Mersey (4½ mls.) ...	3,715	3,767	— 52	116,709	115,694	+ 1,015
*London Passenger Transport Board ...	554,400	545,200	+ 9,200	1,692,600	1,665,200	+ 27,400
IRELAND						
Belfast & C.D. pass. (80 mls.)	6,625	6,345	+ 280	68,549	70,240	— 1,691
,, ,, goods	391	434	— 43	15,888	14,348	+ 1,540
,, ,, total	7,016	6,779	+ 237	84,437	84,588	— 151
†Great Northern pass. (543 mls.)	20,350	17,800	+ 2,550	273,250	266,750	+ 6,500
,, ,, goods	8,500	8,550	— 50	269,450	258,200	+ 11,250
,, ,, total	28,850	26,350	+ 2,500	542,700	524,950	+ 17,750
†Great Southern pass. (2,076 mls.)	46,159	48,264	— 2,105	909,210	896,666	+ 12,544
,, ,, goods	38,604	35,514	+ 3,090	1,139,236	1,076,549	+ 62,687
,, ,, total	84,763	83,778	+ 985	2,048,446	1,973,215	+ 75,231

* 3rd week. † 28th week.

British and Irish Railways Stocks and Shares

Stocks	Highest 1935	Lowest 1935	Prices July 22, 1936	Rise/Fall
G.W.R.				
Cons. Ord. ...	55½	44½	48	—
5% Con. Prefce. ...	124	108	120½	+1½
5% Red.Pref.(1950)	117	106¾	111½	—
4% Deb.	118½	108	113	+1
4½% Deb.... ...	122	110	116½	—
4½ Deb.	129½	118	121½	—
5% Deb.	140¼	130	136½	—
2½% Deb.... ...	82¼	68½	76	—
5% Rt. Charge ...	137	128	132½	+½
5% Cons. Guar. ...	136¾	120½	132½	+½
L.M.S.R.				
Ord.	25 5/16	16	25	+1
4% Prefce. (1923)	58¼	43½	72½	+½
4% Prefce. ...	87½	73½	88½	+½
5% Red.Pref.(1955)	107	97¾	107½	—
4% Deb.	110¼	99½	106½	—
5% Red.Deb.(1952)	119 11/16	111 5/16	116½	—
4% Guar. ...	105⅝	95½	103½	+½
L.N.E.R.				
5% Pref. Ord. ...	15⅞	8¼	10½	+¼
Def. Ord.	7 9/16	4¾	5⅛	—
4% First Prefce.	74¾	48	68½	+½
4% Second Prefce.	31¾	16¼	25½	+½
5% Red.Pref.(1955)	92¼	71	92½	—
4% First Guar. ...	103 11/16	93	100½	+½
4% Second Guar.	98¾	82½	94½	+½
3% Deb.	86	75	82	—
4% Deb.	109¼	98½	105½	—
5% Red.Deb.(1947)	118¼	106½	111½	—
4½% Sinking Fund Red. Deb.	112½	108	109	—
SOUTHERN				
Pref. Ord.... ...	87½	69⅝	92	+1
Def. Ord.	25 13/16	16¾	22½	+½
5% Prefce. ...	124	108¼	121½	+1
5% Red.Pref.(1964)	117¾	109½	118½	—
5% Guar. Prefce.	136½	121½	132½	+1
5% Red.Guar.Pref. (1957)	121¼	112½	119½	—
4% Deb.	116¾	107	112	+1
5% Deb.	138	130¼	135½	—
4% Red. Deb. 1962–67	115	106½	111	—
BELFAST & C.D.				
Ord.	9	4	5	−1
FORTH BRIDGE				
4% Deb.	111¼	104¼	104½	—
4% Guar.	109⅞	104	104½	—
G. NORTHERN (IRELAND)				
Ord.	20	7	16	−½
G. SOUTHERN (IRELAND)				
Ord.	57½	14½	59½	—
Prefce.	50	25¼	58	−2
Guar.	88¾	51¼	85	—
Deb.	86¼	70	90½	−½
L.P.T.B.				
4½% "A" ...	130	119¾	122½	—
5% "A" ...	139¾	130	134½	+1
4½% "T.F.A." ...	113¾	108	109	—
5% "B" ...	131½	122¾	128½	—
"C"	109½	91	105	—
MERSEY				
Ord.	23⅛	9¼	25½	+1
4% Perp. Deb. ...	100½	93½	98*	−1½
3% Perp. Deb. ...	75½	67	74½*	−1½
3% Perp. Prefce.	62	47¼	64½	—

* ex dividend

CONTRACTS AND TENDERS

D. Wickham & Co. Ltd. has received an order from the South African Railways & Harbours Board for five Ford-engined 6–9 seater saloon inspection railcars.

San Paulo Locomotives and Rolling Stock

The San Paulo (Brazilian) Railway has placed orders for locomotives and rolling stock, to the inspection of Messrs. Fox & Mayo, with the following firms :—

Beyer Peacock & Co. Ltd., seven 0-6-2 side tank locomotives.

Birmingham Railway Carriage & Wagon Co. Ltd., ten first class carriages.

Metropolitan - Cammell Carriage & Wagon Co. Ltd., 100 40-ton bogie covered goods wagons.

Gloucester Railway Carriage & Wagon Co. Ltd., 100 40-ton bogie open goods wagons.

Hurst Nelson & Co. Ltd., 100 four-wheeled fruit vans.

Dorman Long & Co. Ltd. has secured a contract to supply and erect 4,170 tons of steel valued at $1,500,000 (Chinese) on a new bridge to be built across the Chian Tang river at Hang-chow.

Boilers, Permanent Way, and Equipment for China

The Chinese Government Purchasing Commission, on behalf of the Ministry of Railways, China, and to the inspection of Messrs. Sandberg, has placed orders for the Canton–Hankow Railway, as follow :—

Robert Stephenson & Co. Ltd. : two superheated locomotive boilers, required respectively for " 50 " and " 100 " class locomotives.

Guest Keen Baldwins Iron & Steel Co. Ltd. : 800 tons of 75-lb. rails.

Barrow Hæmatite Steel Co. Ltd. : 60 tons of fishbolts.

Walker & Wilson Limited : quantity of fish-bolts and nuts.

Chas. Richards & Sons Ltd. : quantity of dogspikes.

The Chinese Government Purchasing Commission has placed orders to the inspection of Messrs. Fox & Mayo, with Glenfield & Kennedy Limited for 12 locomotive water columns and with Reiss Bros. Ltd. for cast-iron pipes required for the Canton–Hankow Railway.

Glenfield & Kennedy Limited has received an order from the Chinese Government Purchasing Commission, to the inspection of Messrs. Fox & Mayo, for a quantity of gate valves, required for the Canton-Hankow Railway.

Ashworth, Ross & Co. Ltd. has received an order from the Mysore State Railways for one 40-ton weighbridge for metre-gauge rolling stock, to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

Fielding & Platt Limited has recently received orders for extrusion plant as follow : two horizontal presses for tubes and sections in magnesium alloys, one horizontal press for sections in aluminium alloys, one 1,000-ton horizontal press for non-ferrous sections and one 1,000-ton vertical tube press of the Serck patent type for which Fielding & Platt Limited are the licensees of manufacture.

Metropolitan-Cammell Carriage & Wagon Co. Ltd. has received an order from Burt, Boulton & Haywood Limited for three 20-ton four-wheeled tank wagons for the conveyance of tar.

Tyres and Machine Tools and other Equipment for India

The Bombay, Baroda & Central India Railway Administration has placed the following orders, to the inspection of Messrs. Rendel, Palmer & Tritton :—

Premier Steel Co. Ltd., on behalf of Klockner-werke A.G. : 200 carriage and wagon tyres.

Fried. Krupp A.G. : 672 locomotive tyres.

Butler Machine Tool Co. Ltd. : one double traversing-head shaping machine.

William Asquith Limited : one radial drilling machine and one horizontal slot drilling and key seating machine.

Alfred Herbert Limited : one capstan lathe and one combination turret lathe.

George Richards & Co. Ltd. : one vertical slot drilling and keyway cutting machine.

George Swift & Sons : one radial drilling machine.

James Archdale & Co. Ltd. : one horizontal plane milling machine.

English Steel Corporation : 60 carriage and wagon axles.

Davies & Metcalfe : 30 vacuum brake ejectors.

Superheater Co. Ltd. : 361 superheater headers.

Metropolitan-Cammell Carriage & Wagon Co. Ltd. : 250 screw couplings.

Gresham & Craven Limited : 18 injectors, and 180 sets and 1,230 separate spare cores.

J. O'Hara Murray, on behalf of Stahlunion Export G.m.b.H. : 350 carriage and wagon buffers.

Ibbotson Bros. & Co. Ltd. : 930 volute springs.

Hill & Jackson Limited : 5,215 helical springs.

The Crown Agents for the Colonies have recently placed the following orders : —

H. W. Ward & Co. Ltd., Capstan lathes.

Loudon Bros. Ltd., Carriage and wagon wheel lathes.

Babcock & Wilcox Limited, Two-ton electrical jib crane.

United Steel Cos. Ltd., Fishplates.

Wolverhampton Corrugated Iron Co. Ltd., Galvanised sheets and ridging.

Whitehead Iron & Steel Company, Mild steel bars.

James Bennie & Sons Ltd., Punching and shearing machine.

P. & W. MacLellan Limited, Rolled steel joists.

Henry Pooley & Son Ltd., Weighbridge and spares.

Stewarts and Lloyds Limited, Wrought-iron galvanised tubes.

Wadkin & Co., Woodworking machinery.

Petters Limited has received an order from the Antofagasta (Chili) & Bolivia Railway for one 5-kW oil-engine-driven direct-coupled station lighting set.

Guest, Keen, Williams Limited has received an order from the Indian Stores Department for 50,000 dogspikes and 70,000 fishbolts.

The Consolidated Brake & Engineering Co. Ltd. has received an order from La Brugeoise et Nicaise & Delcuve, Louvain, for 375 sets of vacuum brake apparatus for bogie drop-sided steel wagons for the South African Railways. The equipment is to be delivered as follows : 115 sets for La Brugeoise et Nicaise & Delcuve, Louvain ; 115 sets for S.A. Les Ateliers Metallurgiques, Nivelles ; 95 sets for S. A. Les Ateliers de La Dyle, Louvain ; and 50 sets for S. A. L'Industrie, Louvain.

Leyland Motors Limited has received an order for nine diesel-engined Tigers from the United Automobile Services Limited.

Jute Industries Limited has received an order for 45,000 grain sacks from the L.M.S.R. The stock of these sacks now available for hire to millers, merchants, and farmers is 617,000.

The South Indian Railway Administration has placed orders to the inspection of Messrs. Robt. White & Partners with John Walsh & Co. (Birmingham) Ltd. for 14¼ tons of galvanised corrugated sheets, and with Robert Ingham, Clark & Co. Ltd. for 5 tons 8 cwt. of body varnish.

The Indian Stores Department is calling for tenders, to be presented in Simla by August 11, for the supply of train lighting dynamos with motoring resistances and terminals ; magnetic battery changeover switches and main magnetic switches. Firms desirous of offering dynamos, &c., of United Kingdom manufacture can obtain further details from the Department of Overseas Trade.

The Chief Controller of Stores, Indian Stores Department (Electrical Section), Simla, invites tenders receivable by August 18 for one two-ton supermobile petrol-driven crane, direct-coupled to a compound-wound d.c. generator.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), Simla, invites the following tenders for machine tools :—

Receivable by August 25 for two jolt ram squeezing mechanical pattern drawing moulding machines, one 3¾ in. forging machine, and one direct-acting portable hydraulic rivetter.

Receivable by August 27 for two portable air-driven piston-valve boring machines, one piston ring and surface grinding machine, and one four-wheel tool grinder with self-contained motor.

All the above described plant is required for the E.I. Railway workshops at Jamalpur.

Tenders are invited by the Chief Controller of Stores, Indian Stores Department (Miscellaneous Section), Simla, receivable by August 3, for glass sheets required for the East Indian, Great Indian Peninsula, and North Western Railways of India.

The Kenya and Uganda Railways and Harbours administration invites tenders, receivable by September 30 next, for the performance of all the following services at the port of Mombasa, namely, cargo-handling work ; truck loading and offloading work ; coal landing, loading, stacking, &c., work. Tender forms and copies of the form of agreement may be had on application to the Port Manager, Mombasa, or to the Crown Agents for the Colonies.

OFFICIAL NOTICES

THE Proprietors of the Patent No. 382,698 for Improvements in or relating to Rail Seatings are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to: HASELTINE, LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

Bengal-Nagpur Railway Company Limited.

THE Directors are prepared to receive tenders for:—

1,020 STEEL CARRIAGE & WAGON TYRES

Specification and form of tender can be obtained at the Company's Offices 132, Gresham House, Old Broad Street, London, E.C.2, on or after Friday, July 24, 1936.

A fee of 10s. will be charged for each copy of the specification, which is NOT returnable.

Tenders must be submitted not later than NOON on Wednesday August 5, 1936.

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

Sudan Government

SUDAN RAILWAYS require the services of TWO ASSISTANT ENGINEERS on two years' Probationary Contract with prospects of eventual appointment to permanent establishment.

Candidates should be 24-27 years of age, single preferred, and should be Associate Members of the Institution of Civil Engineers or possess equivalent University qualifications. Preference will be given to candidates who have had some practical experience in Railway Construction and Maintenance on a British Railway.

Starting rate of pay £E480-540 per annum according to age, qualifications and experience. (£E1 = £1 0s. 6d.)

Candidates will be interviewed in September, 1936. One of the selected candidates will be required to proceed to the Sudan not later than 1st October, 1936, the other early in January, 1937.

Applications, giving full particulars of age, qualifications and experience, should reach the office of the Controller, Sudan Government London Office, Wellington House, Buckingham Gate, London, S.W.1, by 15th August, 1936. Envelopes to be marked "Railways Engineer."

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for:—

BOLTS, NUTS, RIVETS, &c.

Specification and Form of Tender can be obtained at the Company's Offices, 25, Buckingham Palace Road, Westminster, S.W.1.

Fee ONE GUINEA, *which will not be returned.*

Tenders must be submitted not later than 2 o'clock p.m. on TUESDAY, 11TH AUGUST, 1936.

The Directors do not bind themselves to accept the lowest or any Tender and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
G. W. V. DE RHE PHILIPE,
Secretary.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

RAILWAY AND OTHER MEETINGS

Bombay, Baroda and Central India Railway Company

The ordinary general meeting of the Bombay, Baroda and Central India Railway was held at Southern House, Cannon Street, E.C., on Wednesday, Major A. D. G. Shelley, R.E., Chairman of the company, presiding.

The Secretary, Mr. S. G. S. Young, read the notice convening the meeting.

The Chairman, in moving the adoption of the report and accounts, said that the total length of lines worked by the company as shown in the report was 3,691. This mileage was practically the same as in the previous year, but on April 1 last the administration of the Jaipur State Railway was taken over by that State, reducing the mileage now in the company's charge by about 180 miles. They had no direct interest in the earnings of that railway, and no loss to the main line was anticipated from the change in administration.

Although expenditure on capital account amounted to only about Rs. 21½ lakhs, which was somewhat less than in the previous year, the building of the new double-track bridge over the Nerbudda River was completed, while the extension of the suburban electrified system to Virar, 35 miles from Bombay, was well advanced. The new Nerbudda bridge, which had been named the Silver Jubilee bridge, was opened to public traffic by the Governor of Bombay on December 20 last, and the extension of the electrified system would be opened early next month.

Turning to the revenue account, it would be seen that the recovery from the low level of earnings touched in 1931-32 still continued, although the high level of 1928-29 had not yet been reached. It was, however, satisfactory to note that the increase occurred in both coaching and goods traffic, pointing to a general improvement in trade conditions.

The increase of about Rs. 16¾ lakhs in gross earnings was accompanied by a decrease in expenditure of about Rs. 19 lakhs, which was chiefly due to less expenditure on structural works and on coal. Expenditure on salaries and wages was, however, increased by the final removal of the special cuts which had operated during the financial emergencies of the three previous years.

The gross earnings for the first quarter of the current year showed an increase of about 8 per cent. over those of the corresponding period of the previous year, and although it would be optimistic to expect that this rate of interest would continue, a further steady improvement in earnings might reasonably be looked for. Although working expenses might also increase to some extent, he hoped that the percentage of expenses to receipts would remain at about the present level, and that therefore the net result of the year's working would show an improvement, if slight, on last year's.

The dividend now being recommended in respect of the past year was the usual one of 6 per cent., and after payment of this and the ordinary charges debitable to revenue account, there would remain a net surplus of about £8,000 as the result of the year's transactions. While the nominal balance at credit of the stockholders' revenue account at March 31 last amounted to £172,774 17s. 6d., market prices of the investments in the general balance sheet showed considerable appreciation over the booked costs, and the amount available for dividend equalisation purposes or any exceptional expenditure was therefore somewhat in excess of 10 per cent. of the company's capital. He thought shareholders would agree with him that the company's financial position might be regarded as satisfactory.

The report and accounts having been adopted, the Chairman proposed the declaration of a dividend of 6 per cent. on the capital stock. Sir Henry Burt seconded, and the motion was carried. The meeting concluded with a vote of thanks proposed by the Chairman to the company's Agent and staff in India, to whose efforts they were indebted for the long maintenance of their 6 per cent. dividend. Sir M. W. Brayshay, who was present at the meeting, acknowledged the vote on his own behalf and that of the staff. A further vote of thanks was passed to the Chairman for his conduct of the company's affairs.

Forthcoming Meetings

July 24 (*Fri.*)—**Egyptian Delta Light Railways Limited** (Ordinary General), Winchester House, Old Broad Street, E.C.2, at 11 a.m.

July 27 (*Mon.*)—**Nyasaland Railways Limited** (Annual General), 3 Thames House, Queen Street Place, E.C.4, at 11.15 a.m.

July 30 (*Thurs.*)—**La Guaira and Caracas Railway Co., Ltd.** (Ordinary General), Dashwood House, 69, Old Broad Street, E.C., at 11 a.m.

July 31 (*Fri.*)—**Fishguard and Rosslare Railways and Harbours Company** (Half Yearly Ordinary), Paddington Station, W.2, at 1 p.m.

Aug. 11 (*Tue.*)—**Weymouth and Portland Railway Company** (Ordinary Half-yearly), 38, Bedford Row, W.C.1, at 12 noon.

CANADIAN PACIFIC LONDON OFFICE.—The head office address in London of the Canadian Pacific Railway Company has been changed from 62-5, Charing Cross, to Trafalgar Square, S.W.1.

XUM

Railway Share Market

Partly as a result of the general increase of activity in the stock and share markets, and partly owing to the past week's excellent traffic figures, Home railway stocks were more prominent towards the middle of the week. The market still does not expect the half-yearly dividend payments will show any material change from those of a year ago, but it is hoped that the statements will disclose that a good part of the increased gross receipts is reflected in the net revenue for the half-year. The assumption is that at this stage a conservative dividend policy is likely, pending settlement of the wages question. The past week's traffics had a stimulating influence because they tended to revive hopes that takings for the rest of the year may be accelerated. Both the L.M.S. and L.N.E. are expected to benefit from continued expansion of activity in the centres of the heavy industries, as is the Great Western, while, as mentioned here before, the Southern usually has its best period in the second six months of the year.

L.M.S. ordinary were good with a rise to 25 on the past week's traffic gain of £159,000, and the 4 per cent. and 1923 preference stocks were also firm at 88½ and 72½ respectively. L.N.E. first and second preference were better, the traffic gain in this case being £78,000. No doubt the response in prices would have been stronger if there had not been fears that the impending L.N.E. interim statement may indicate that larger sums are being spent on equipment. Gains of half a point were made by the first guaranteed and second guaranteed stocks. Great Western were fractionally better at 48¼, the £11,000 rise in last week's receipts being up to expectations. Southern stocks participated in the better tendency, although the traffic gain in this case was only £1,000. The preferred attracted rather more attention than the deferred, but the latter put on ¼ to 22⅜ on Wednesday. London Transport "C" was again dull.

Argentine railway stocks were good in the foreign railway market, due largely to the influence of improved traffic figures and rather more favourable views as to the outlook for the latter. B.A. Great Southern showed the best recovery and is now 16, and better prices were also shown by Central Argentine and B.A. Western. Argentine Great Western 5 per cent. debentures were good with a rise of two points, and B.A. Pacific debentures were higher. Canadian Pacific issues were dull on less favourable crop reports.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: July 22, 1936	Yield (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	834	19.7.36	13,840	+ 2,470	29	392,400	359,170	+ 33,230	Ord. Stk.	23	14 15/16	17	Nil
	Argentine North Eastern ..	753	18.7.36	9,725	+ 1,987	3	22,672	23,024	— 352	,,	7	4	3 1/2	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	49 1/2	30	47 1/2	8 7/16
	Bolivar	174	June, 1936	6,200	+ 200	26	41,000	39,400	+ 1,600	6 p.c. Deb.	13	5	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	14	11	17 1/2	3 1/8
	Buenos Ayres & Pacific ..	2,806	18.7.36	76,932	+ 2,314	3	191,788	217,138	— 25 350	Ord. Stk.	10 1/2	4 7/8	7 1/2	Nil
	Buenos Ayres Central ..	190	4.7.36	$115,400	— $17,300	1	$155,400	$132,700	— $17,300	Mt. Deb.	21	10	16 1/2	Nil
	Buenos Ayres Gt. Southern	5,084	18.7.36	108,431	— 5,553	3	276,617	329,147	— 52,530	Ord. Stk.	27	13 1/2	16	Nil
	Buenos Ayres Western ..	1,930	18.7.36	41,862	+ 7,197	3	99,543	115,709	— 16,166	,,	24	10	12 1/2	Nil
	Central Argentine	3,700	18.7.36	130,053	+ 215	3	319,133	367,380	— 48,247	,,	17 7/8	7	10 1/2	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	9	3 1/4	6 1/2	Nil
	Cent. Uruguay of M. Video	273	11.7.36	10,459	+ 2,420	2	16,878	15,782	+ 1,096	Ord. Stk.	8 1/2	3	4	Nil
	Do. Eastern Extn.	311	11.7.36	1,738	— 107	2	2,890	3,204	— 314	—	—	—	—	—
	Do. Northern Extn.	185	11.7.36	1,717	+ 408	2	2,530	2,337	+ 193	—	—	—	—	—
	Do. Western Extn...	211	11.7.36	999	+ 415	2	1,519	1,055	+ 464	—	—	—	—	—
	Cordoba Central	1,218	18.7.36	27,120	+ 3,450	3	95,100	103,670	— 8,570	Ord. Inc.	4	1	1 1/2	Nil
	Costa Rica	188	May, 1936	17,449	+ 3,582	48	159,922	176,238	— 16,316	Stk.	35	30	33 1/2 §	6
	Dorada	70	June, 1936	13,600	+ 1 800	26	79,300	66,800	+ 12,500	1 Mt. Db.	103 5/8	102 1/2	104 1/2	5 3/4
	Entre Rios	810	18.7.36	12,810	+ 1,506	3	29,711	33 319	— 3,608	Ord. Stk.	15	6 1/2	7	Nil
	Great Western of Brazil ..	1,082	18.7.36	6,400	+ 1,500	29	222,400	227,100	— 4,700	Ord. Sh.	1/2	5/16	1/2	Nil
	International of Cl. Amer.	794	May, 1936	$536,930	+ $39,880	21	$2,617,600	$2,260,638	+ $356,962	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/2	3/32	1/2	Nil
	La Guaira & Caracas ..	22¾	June, 1936	4,460	+ 545	26	27,340	23,845	+ 3,495	Stk.	8 1/2	8	5 1/2	Nil
	Leopoldina	1,918	18.7.36	21,248	+ 1,216	29	498,933	458,245	+ 40,688	Ord. Stk.	8 1/2	2 1/2	4 1/2	Nil
	Mexican	483	14.7.36	$221,700	— $26,600	2	$441,000	$491.300	— $50,300	,,	1 1/2	1/4	3/4	Nil
	Midland of Uruguay ..	319	June, 1936	7,545	+ 1,791	52	86,428	111,833	— 25,405	,,	1 1/2	1 1/2	1 1/2	Nil
	Nitrate	401	15.7.36	6,495	— 1,986	28	76 055	80,994	— 4,939	Ord. Sh.	64/-	42/-	2 5/8	Nil
	Paraguay Central	274	11.7.36	$2,579,000	+ $655,900	2	$4,218,000	$3,516,000	+ $702,000	Pr. Li. Stk.	80 1/2	60	73 1/2	8 5/16
	Peruvian Corporation ..	1,059	June, 1936	83,124	+ 16 368	52	949,493	764,032	+ 185,461	Pref.	105 5/8	67 1/16	111 1/2	Nil
	Salvador	100	18.7.36	¢13,600	+ ¢956	3	¢30,043	¢36,288	— ¢6,245	Pr. Li.Db.	65	61	30	16 11/16
	San Paulo	153½	12.7.36	29,900	+ 4,826	23	820,182	663,099	+ 157,083	Ord. Stk.	80	35	48 1/2	5 1/8
	Taltal	164	June, 1936	4,220	+ 1,345	52	42,725	36,940	+ 5,785	Ord. Sh.	1 11/16	1 1/8	7/8	17 1/8
	United of Havana	1,353	18.7.36	16,386	— 5,161	3	41,705	57,666	— 15,961	Ord. Stk.	3 1/16	1	2 1/2	Nil
	Uruguay Northern	73	June, 1936	778	+ 154	52	9,922	12,107	— 2,185	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,617	14.7.36	702,655	+ 41,376	28	18,437,363	17,304,254	+ 1,133,109	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c	Perp. Dbs.	78 5/8	52 1/2	66 1/2	6
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	103 5/8	93	101 1/2	3 15/16
	Canadian Pacific	17,237	14.7.36	500,400	+ 14,800	28	13 455,600	12,279,200	+ 1,176,400	Ord. Stk.	14 1/16	8 3/4	13	Nil
India.†	Assam Bengal	1,329	30.6.36	35,527	+ 3,006	13	310,557	296,367	+ 14,190	Ord. Stk.	92 1/8	77 1/2	84 1/2	3 9/16
	Barsi Light	202	20.6.36	2,745	— 682	12	27,825	30 855	— 3,030	Ord. Sh.	105	77 1/2	72 1/2	6 7/8
	Bengal & North Western ..	2,112	30.6.36	69,744	+ 1,695	13	729,006	705,028	+ 23,978	Ord. Stk.	301 1/2	291	308	5 5/16
	Bengal Dooars & Extension	161	20.6.36	3,418	— 403	12	23,895	25,939	— 1,044	,,	127 1/2	122	125 1/2	5 9/16
	Bengal-Nagpur	3,268	30.6.36	161,250	— 22,453	13	1,611,977	1,704,722	— 92,745	,,	105	100 5/16	102 1/2	3 7/8
	Bombay, Baroda & Cl. India	3,072	10.7.36	195.375	— 6,450	14	2,539,800	2,380,425	+ 159,375	,,	115 1/4	110	111 1/2	5 7/8
	Madras & Southern Mahratta	3,229	30.6.36	154 875	— 2,563	13	1,501,616	1,475,871	+ 25,745	,,	128 1/2	113 7/8	112 1/2	8
	Rohilkund & Kumaon ..	561	30.6.36	10.851	— 2,565	13	151,424	141,004	+ 10,420	,,	294	262	303 1/2	5 1/4
	South India	2,531	30.6.36	106.139	— 2,826	13	1,031,016	1,053,764	— 22.748	,,	119 3/4	104 1/4	103 1/2	5 5/16
Various.	Beira-Umtali	204	May, 1936	70,177	+ 124	35	513,150	520 214	— 7,064	—	—	—	—	—
	Bilbao River & Cantabrian	15	June, 1936	1,397	+ 136	26	8,525	9,905	— 1,380	—	—	—	—	—
	Egyptian Delta	620	30.6.36	5,883	+ 962	13	51,167	46.629	+ 4,538	Prf. Sh.	2	15/8	1 5/4	5 11/16
	Great Southern of Spain ..	104	11.7.36	857	— 66	28	30,378	50,610	— 20,232	Inc. Deb.	3 1/2	2	3 1/2	Nil
	Kenya & Uganda	1,625	May., 1936	238,820	+ 37,731	22	1,226,510	1,129,621	+ 96,889	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48	36	42	8 5/16
	Mashonaland	913	May, 1936	105,936	— 19,948	35	815 155	945.921	— 130,766	1 Mg. Db.	104 1/4	100	103	4 7/8
	Midland of W. Australia ..	277	May, 1936	11,949	— 1,099	48	149.410	147 835	+ 1,575	Inc. Deb.	98 3/4	93	93 1/2	5 5/16
	Nigerian	1,905	30.5.36	25,822	+ 3.677	9	275,157	243.065	+ 32,092	—	—	—	—	—
	Rhodesia	1,538	May, 1936	182,817	— 15,586	35	1,479,847	1,542.173	— 62,326	4 p.c. Db.	105 1/2	101	105	3 15/16
	South African	13,256	27.6.36	631,276	+ 37,686	13	7,345,168	6,793.237	+ 551,931	—	—	—	—	—
	Victoria	4,728	Dec., 1935	866.995	— 3 320	26	4,826 292	4,751,974	+ 74,318	—	—	—	—	—
	Zafra & Huelva	112	May, 1936	8,821	— 2,027	22	48,574	55,398	— 6,823	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value.

Electric Railway Traction

Underground Improvements

THE first of a number of improvements designed to give greater comfort and faster and more efficient operation on the Metropolitan and District lines of the London Passenger Transport Board has appeared in the form of the new train on the Hammersmith and City route, and described elsewhere in this issue. This train may be described as a half-way step in the efforts to modernise the old Metropolitan and District stock. It has a steel body, Alpax doors, and is fitted with Westinghouse electro-pneumatic brakes which diminish the time lag of the application on the last car. Another new feature is the provision of individual door control by air, the passengers merely pressing push buttons on the door pillars, to open the doors. These doors can be closed through air pressure by the guard, and the whole system is a compromise between the hand-operated doors of the Metropolitan and District trains and the remotely-controlled doors of the deep-level tube trains. This new train is not fitted with metadyne control, but a comprehensive programme of rebuilding old cars is being carried out by the Transport Board, and 116 vehicles are now under conversion to the metadyne system, and will have other modifications such as steel side panels and body framing in place of the old wood construction. All these vehicles will be fitted with roller bearings, following the decision of the Board to replace all the plain bearings on its underground stock with those of the anti-friction type.

Austrian Electrification

THE total route length of the Austrian Federal Railways electrified at the end of 1935 amounted to 899 km., an increase of 35 km. over the 1934 total due to the conversion of the south bank of the Tauern line, which cost 6,595,280 schillings. The traction energy consumption for 1935 was 142,800,000 kWh., equivalent to 57·387 kWh. per million tonne-km. and 11·08 kWh. per thousand locomotive-km. measured at the power station bus-bars. The energy cost for 1935 was only 10,290,000 schillings compared with 11,860,000 schillings in 1934, when the consumption was 137,100,000 kWh., these figures corresponding to 7·2 and 8·7 groschen per unit respectively. The above costs include the interest charges on the initial cost of the four railway-owned hydro-electric stations, which charges formed a total of 4,808,000 schillings out of a total power station expenditure for the year of 7,658,384 schillings. The wages cost for the staff of the four railway-owned power stations and three lighting stations, with an aggregate capacity of 67,000 kW., was only 398,692 schillings. The maximum daily load over the system was 520,000 kWh. Electric train-km. for the year 1935 amounted to 10,077,000, of which 3,203,000 km. were by goods trains and 6,874,000 km. by passenger trains. The electric locomotive-km. totalled 12,860,000, the relatively large proportion to the train-km. being due to the frequent double heading over the Arlberg route. The electric train-km. were 21 per cent. of the total train-kilometrage of the entire Austrian Federal system, and the 2,489 million tonne-km. on the electric lines formed 20·8 per cent. of the total, although there is scarcely 16·5 per cent. of the route mileage converted. The electric stock at the end of 1935 comprised 218 locomotives, 17 motor-coaches, and a number of works vehicles. The capital invested in electrification since the war by the Federal Railways is 535,436,884 schillings, but of course this figure does not include the cost of converting the Mariazell, Hainburg, and Mittenwald lines.

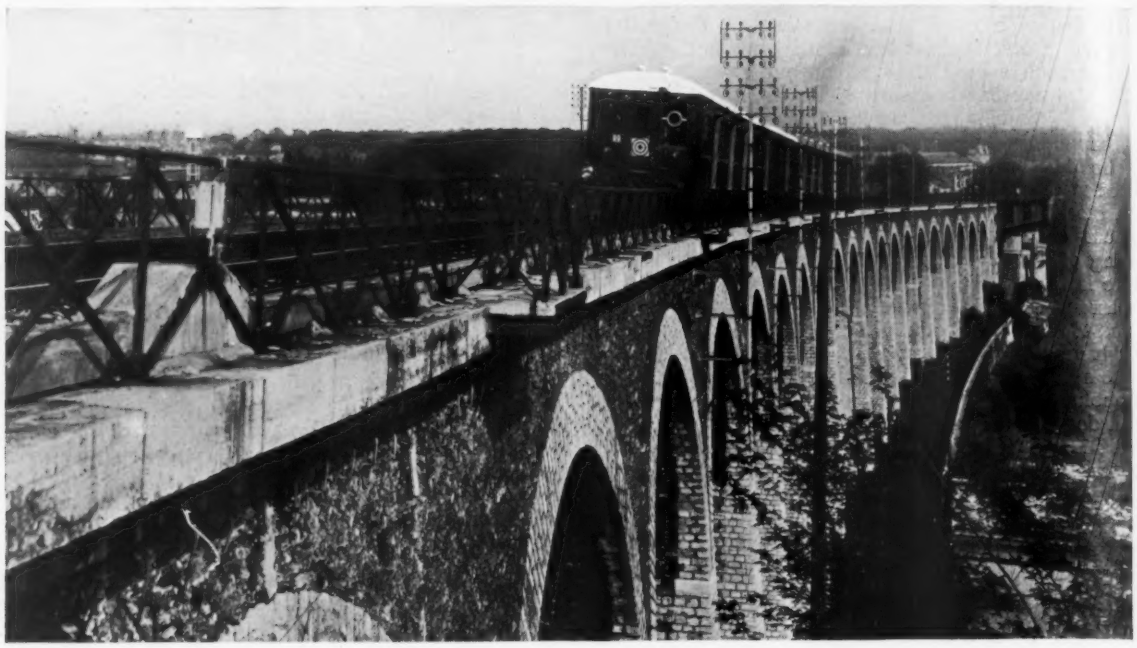
The Höllental Railway

ANOTHER attempt to use the industrial supply at 50 cycles for railway traction is being made in the Black Forest, where partial electric operation is now in force over the famous Höllentalbahn between Freiburg and Neustadt, which has long grades of 1 in 18. The power is obtained from the German 50-cycle network through Scott-connected transformers, and the tension in the contact wire is 20 kV. Three 2,000 h.p. locomotives have been delivered and a fourth is in course of delivery. Two of the four locomotives, those with electrical equipment supplied respectively by Brown Boveri and the A.E.G., are of the rectifier type and have d.c. motors. The third, built by the Siemens-Schuckertwerke, has four twin motors of the single-phase type. Krupp is building the fourth locomotive, which is understood to be a development of the Punga-Schön principle. Although the operation is believed to have been reasonably satisfactory up to the present, following as it did lengthy trials of the locomotives, traffic over the line was disturbed for two or three days at the beginning of this month as a result of a landslide at Posthalde, following continuous bad weather. During the electrification of the line, which has been carried out over the past two years, opportunity was taken to remodel a number of the passenger stations at the Freiburg end of the line, and the whole line has been relaid and greatly improved in alignment.

Electric Railcar Services in Switzerland

A CONSIDERABLE extension of fast electric motor-coach services has taken place in Switzerland consequent upon the introduction of further vehicles of the semi-streamlined Red Arrow type, described in the issues of this Supplement for July 27, 1934 and March 8, 1935. The ground covered by these motor-coaches now extends from Vallorbe and Lausanne in the west to Romanshorn and St. Gall in the east, and the working is grouped in three divisions. In the first, or western division, the motor-coach concerned leaves Lausanne at 7.15 and makes a return trip to Delémont, a return trip to Vallorbe, and a return trip to Berne via Bienne, and finishes at Lausanne at 23.25 after covering a mileage of 414. The second operating division vehicle is worked from Berne as a centre, and, beginning at 6.22, makes return trips to Burgdorf, Olten, and Lyss and a round trip Berne-Olten-Wohlen-Olten-Lucerne-Berne, and finishes at the Swiss capital at 0.14, after making a mileage of 409. Zurich is the depot of the motor-coach in the third division, and the starting time in the morning is 6.36. The first duty is a return trip to Zug, via Affoltern, and then follows a journey to Romanshorn, back to Sulgen, then to St. Gall, and return to Zurich via Sulgen and Winterthur. In the afternoon and evening return trips are made from Zurich to Schaffhausen, Rapperswill, and Lachen, the car finishing its turn at 21.33 after a mileage of 350. Generally, these Red Arrow cars are run on accelerated timings with stops at all stations, but certain of the turns are express trips including a non-stop run from Berne to Bienne, 20¾ miles, in 26 min.

THE ELECTRIFIED SUBURBAN LINES OF THE FRENCH STATE RAILWAYS

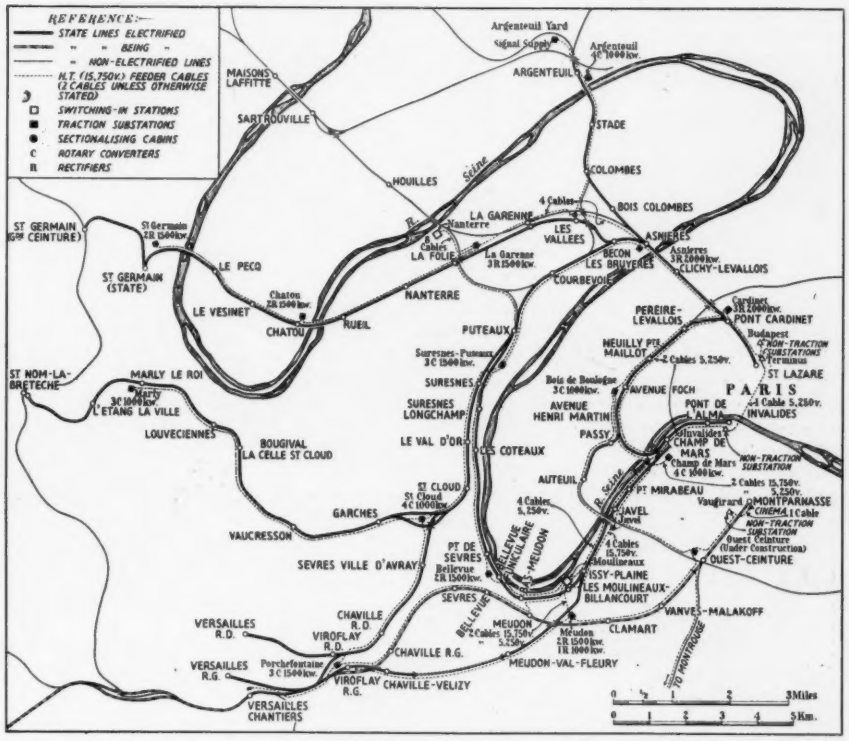


Suburban train on the 650 volt d.c. lines of the French State Railways crossing the stone viaduct at Le Pecq on the Paris—St. Germain line

BEGINNING in 1900 with the conversion to the 650-volt d.c. system of the Paris (Invalides)—Versailles (Rive Gauche) line, the electrification of the lines now included in the Paris suburban system of the French State Railways was not extended further until 1924, when a comprehensive conversion programme was put in hand. The system now comprises 73 route and 163 track miles, all of which except the Invalides-Versailles and Bois Colombes to Argenteuil lines were electrified between 1924 and 1931. The Argenteuil line was opened to electric traction in January last. Apart from the short section from St. Germain (Etat) to St. Germain (Grande Ceinture), all the routes have two or more tracks.

The present electrified system as shown on the accompanying map is fed by 14 traction substations with an aggregate capacity of 53,500 kW., and the annual energy consumption is in excess of 40,000,000 kWh., including the large amount of current required for heating the trains. Approximately 70,000,000 passengers are carried in the electric trains each year and the train mileage is about 3,800,000. The rolling stock comprises 249 motor-coaches and 202 trailers which operate a normal service of 900 trains a day out of St. Lazare and about 200 from Invalides. The capital invested amounts to 477,000,000 fr. comprising 226,000,000 fr. for material, traction, and electrical equipment, and 251,000,000 fr. for way and works. In addition to the foregoing, the Paris (Montparnasse)-Le Mans main line is now being electrified. Over

All-steel driving trailer as used on the Paris suburban lines of the Etat. It has 74 seats and room for 97 passengers standing, on a tare weight of 38·5 tonnes



Map showing the 650-volt d.c. Paris suburban lines of the French State Railways and also the line out towards Rambouillet and Le Mans, which is being electrified on the 1,500 volt d.c. system

it, besides the locomotive-hauled long-distance trains, streamlined stainless steel fast suburban trains will run as far as Rambouillet, as well as normal suburban trains to the Versailles district.

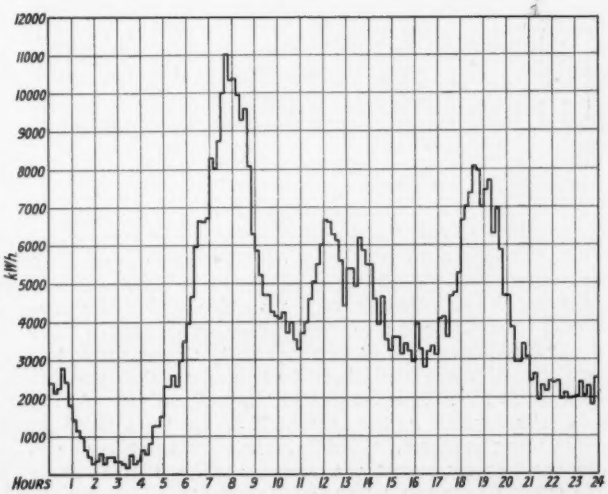
Power Supply and Distribution

The energy for the whole of the Etat electrified suburban system is supplied by the Union d'Electricite, from its network of steam power stations, to two switching-in stations, at Nanterre in the northern suburban area, and Issy-les-Moulineaux in the south. These switching-in stations correspond in function to the grid substations in Britain. Prior to 1931 there were two generating stations belonging to the railway, and they generated current at 25 cycles. In that year, these stations were closed and the supply obtained from the Paris network, and all the substation equipment was changed to suit the new frequency of 50 cycles. The energy is now supplied at a voltage of 15,750 through double cables, and in addition to carrying the supply for traction purposes they feed certain lighting and miscellaneous equipment, such as the cinema at Montparnasse station.

For the year 1934 the energy consumption was equivalent to 6·58 kWh. per train-km. (10·55 kWh. per train-mile) and 3·11 kWh. per 100 tonne-km. (4·93 kWh. per 100 ton-miles). For 1935 the figures were 6·77 kWh. per train-km. (10·85 kWh. per train-mile) and 3·0 kWh. per 100 tonne-km. (4·76 kWh. per 100 ton-miles). Taken over a full year the total consumption is about 40,000,000 kWh. of which almost 10,000,000 kWh. are required for heating the trains. The cost of the current is 0·28 fr. per kWh. measured at the switching-in stations. All these figures are without the short section from Bois Colombes to Argenteuil, which was not opened until the present year. The daily power demand rises to a peak of 11,000 kWh. during the morning rush period and the variation throughout the 24 hr. is shown in one of the accompanying illustrations.

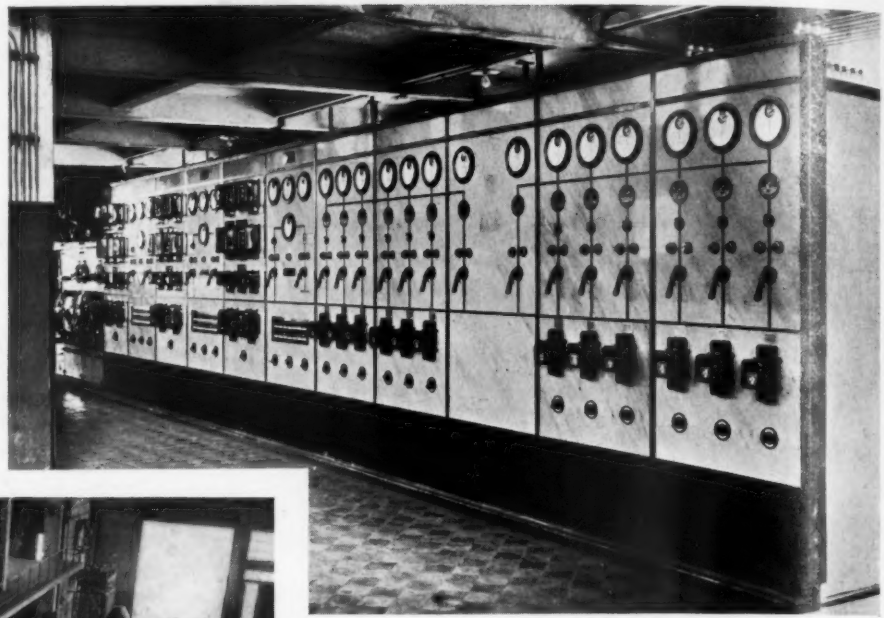
Of the 14 substations, seven have rotary converter equipments and seven have mercury arc rectifiers. One of the rotary converter plants and five of the rectifier plants are automatic in their operation, and these equipments can be partially controlled from the nearest passenger station, where the stationmaster can, when required, start or stop the converting apparatus and disconnect the main circuit breakers and feeders.

A feature of all the substations is that the transformers are located indoors. Their connections vary somewhat between the different substations. Of the rectifier substations those at Asnières and Cardinet have three-phase/six-phase; at Garenne there are two types of transformer connections, one three-phase-double three-phase and one three-phase/six-phase. In certain substations the oil-cooled transformers are shut off from the remainder of the sub-

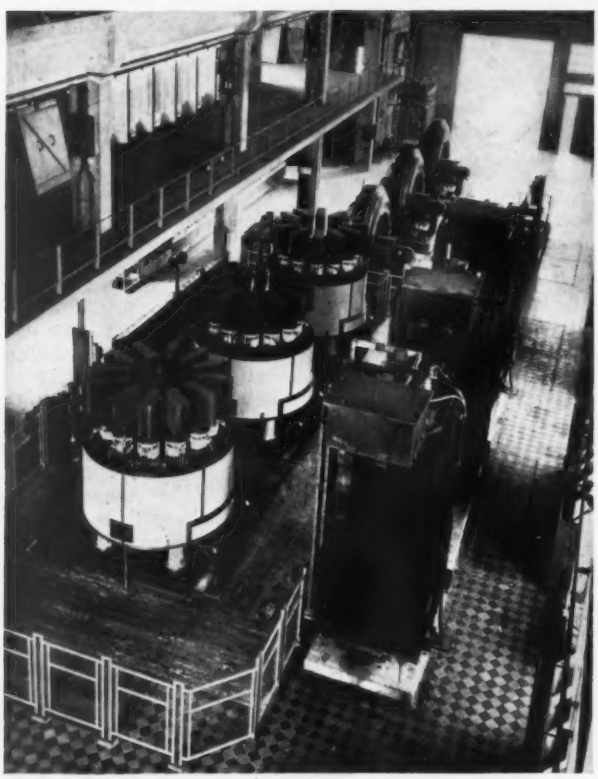


Variation in the load supplied to the Etat electrified suburban system over a period of 24 hours

Right: Control board for the automatic operation of the mercury rectifiers and feeders at Asnières substation



Below: Interior of Asnières substation in 1931, as the rotary converters were being taken out and three 2,000 kW. rectifiers installed



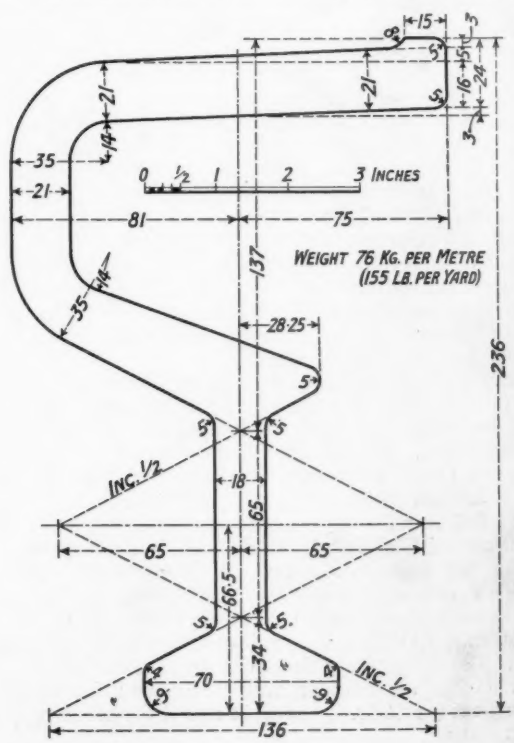
station by steel roller doors which are interlocked with the high-tension apparatus.

The mercury arc rectifiers are of three makes, viz., Brown Boveri, A.E.G., and Cie. Electro-Mecanique. A standard size is not used throughout the system, and there are units of 1,000, 1,500 and 2,000 kW. continuous capacity. The illustration of the interior of Asnières substation actually shows the equipment as it was in 1931 during the change-over of frequency. The three converters form the old equipment about to be taken away, and the three 2,000 kW. rectifiers had just been installed. At the automatic substations the automatic operation is extended to the track breakers. Should a track breaker trip due to any fault on the line, three attempts to close it are made by the automatic control apparatus.

From the track feeders the 650-volt d.c. is taken to the third rails which are of an unusual shape (see attached drawing) and have a weight of no less than 155 lb. per yd. The resistance is equal to 11 microhm-centimetres, and the rails are electrically connected by welded bonds. The return current is taken through the running rails, and at no point on the system is a fourth rail laid down. The running rails weigh 94 and 110 lb. per yd.

Engineering and Signalling Features

One of the main reasons for the electrification of the Invalides-Versailles route in 1900 was the difficulty of operating dense traffic over the lengthy 1 in 100 grades



Third rail as used on the 650-volt d.c. Etat system

The new fly-over junction at Bois Colombes, forming part of extensive realignment works undertaken by the French State Railways in the neighbourhood of Paris for the suppression of level crossings on road and rail

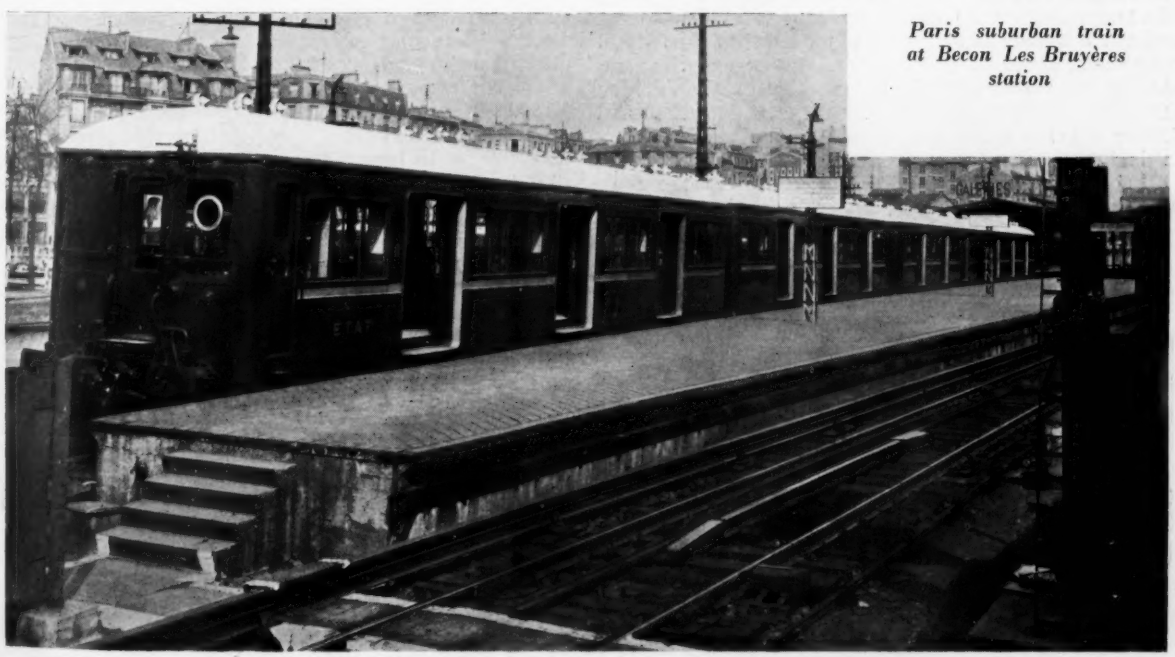
and through the 2-mile tunnel between Meudon and Chaville, which carries both main line and suburban traffic. There are a number of viaducts on this route, and certain of the other suburban routes have notable works, such as the stone viaduct at Le Pecq on the St. Germain branch.

Within the last ten years the approach to St. Lazare terminus has been modified considerably, and a number of flying junctions have been built in the electrified suburban area to keep the main lines clear of electric trains. Certain sections, such as that between Neuilly and Auteuil on the "inner circle," have been covered over to form a subway and release ground for building purposes. Flying junctions were built and extensive re-aligning carried out last year between Bois Colombes and Le Stade, at the time the Argenteuil line was being electrified, the principal aims being to suppress a number of level crossings and separate the fast and suburban tracks. Bois Colombes station is now below the normal street level, and Colombes and Le Stade are above the street, the island platforms of the last-named two being on a big embankment partly formed of a series of concrete arches. These three stations are entirely new.

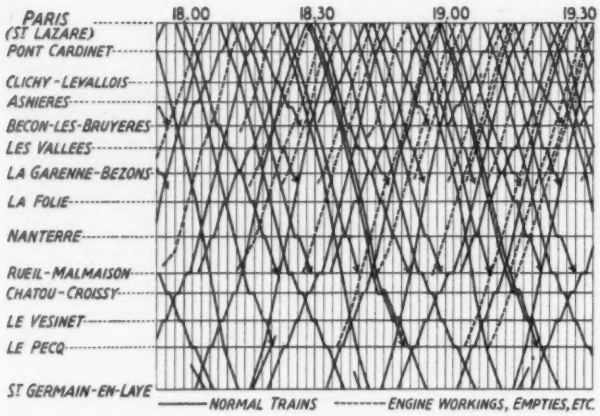
Power and automatic colour-light signalling has been installed on the electrified system. Automatic block signalling was tried first on the St. Germain line in 1923, and in 1924 automatic colour-light signals were installed on the Issy-Meudon section. A similar installation was put into service in 1928 over the whole of the Invalides-Versailles division. In 1927 colour-light signals were fitted between Bécon and St. Germain, where 73 light signals replaced 150 semaphores, and similar signals have been installed since on the routes leading out of St. Lazare. Track circuiting of the a.c. type is used.

Rolling Stock

The general unit formation of the 451 electric passenger vehicles is a two-car set comprising one motor-coach and one trailer, and these run as two, four and six car trains. There are a few trains which are marshalled solely of



Paris suburban train at Becon Les Bruyères station



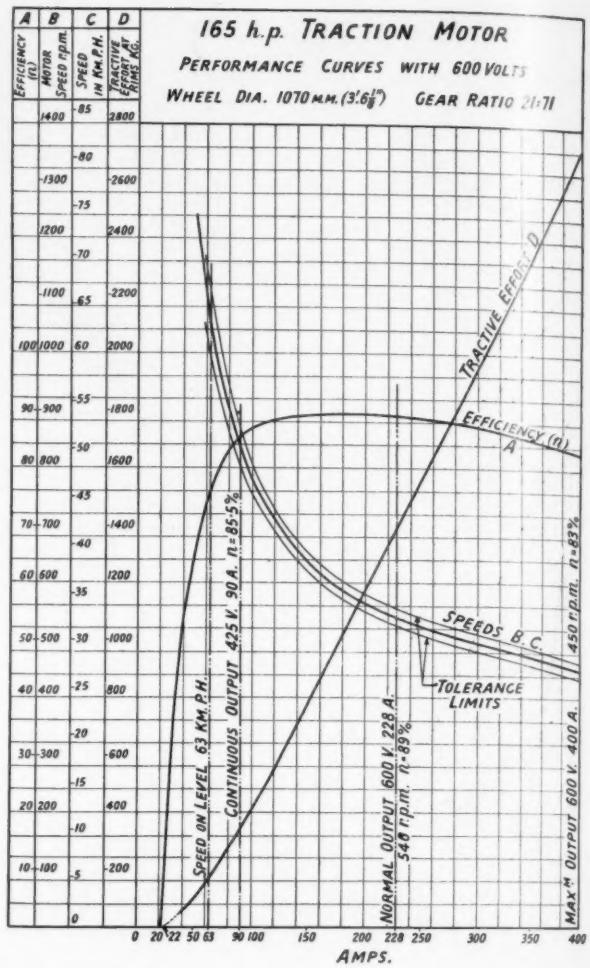
Graphic timetable showing the busiest part of the day on the St. Germain line, Paris suburban system

motor-coaches, the maximum make-up being five vehicles. Additional to the stock mentioned above are 30 Bo-Bo locomotives and 9 motor-baggage vans. These locomotives are used on suburban trains made up of four-wheeled and six-wheeled ordinary carriages.

There are five series of motor-coaches, the first having two 123 h.p. motors and the remainder four 165 h.p. units. The older types, including the first class of 660 h.p. cars were built for the Invalides-Versailles route. The pre-war cars had Sprague and Sprague-Thomson control apparatus, but Alsthom, Jeumont, and C.E.M. types have been fitted to the cars built since 1921. All the cars are of the double-bogie type, but the 26 cars of the second series, built in 1911, have six-wheeled bogies with a motor on the two end axles of each bogie. Certain of the earlier cars had a form of individual axle drive with a quill surrounding the axle and driving springs in the wheels.

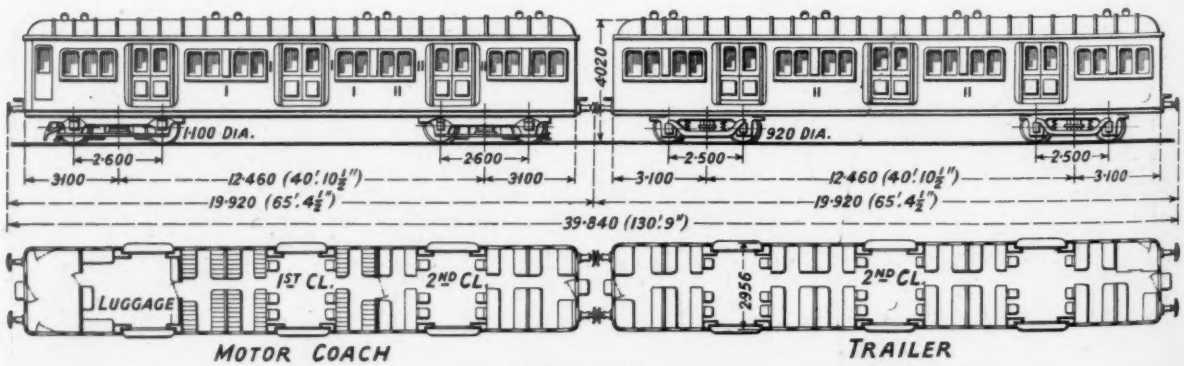
A typical two-car set, of the fifth series, built in 1929, is shown in one of the accompanying diagrams. It has first and second class accommodation in the motor-coach, and second class only in the trailer. No third class accommodation is provided in the Etat electric suburban trains. The tare weight of the all-steel motor coaches is 59 tonnes and of the trailers 39 tonnes. The total seating capacity of the two-car set is 34 first class and 126 second class, including the tip-up seats in the vestibules. In addition there is standing space (crush load) for 35 first class and 132 second class passengers plus an additional 30 standing in the luggage van.

Motor bogies with a wheelbase of 8 ft. 6½ in. are used, and they have swing bolsters with triple elliptical laminated



Characteristic curves of 165 h.p. motor used on the suburban trains of the Etat

springs at each side. The main side frames and cross stretchers are steel castings and this construction is used also for such details as the brake hangers. The axleboxes are of the S.K.F. roller bearing type with short triple helical springs above. Air brakes, with cylinders mounted on the car underframe, operate clasp type brakes with two adjustable blocks on each wheel. The cars and trailers have ordinary side buffers and centre couplers of the Boirault type. No power mechanism is used to open



Two-car set used on the Paris suburban lines of the French State Railways

or close the side doors of the passenger saloons. The torque reaction of the nose-suspended motors is taken through four helical springs carried in brackets on the main cast steel transoms. The performance curves of the motor itself are shown on one of the diagrams reproduced herewith.

Repair of the electric rolling stock is undertaken at La Folie, on the St. Germain line. These works employ about 450 men. Running repairs and ordinary maintenance work are carried out at four depots, viz. Champ-de-Mars, Versailles (R.D.), Rueil, and Bois Colombes, each of which employs about 50 men. In general, the train sets are brought in to La Folie for repairs after 150,000 km. (94,000 miles), and general inspections are made at the depots every 15 days.

Train Services

For the convenience of the public and the operating staff, the suburban (*banlieue*) lines running into St. Lazare are divided into two groups, the *petite banlieue* and *grande banlieue*. The former includes all the electrified lines, and the second group the outer suburban routes, such as those to Achères, Conflans, and Mantes, which are worked partly by push-and-pull steam trains formed of all-steel coaches, some of which are double decked. On a normal week-day there are 410 electric trains entering and 403 leaving St. Lazare and corresponding totals of 83 and 88 steam trains on the *grande banlieue* lines. On the other side of the river, at Invalides, 99 electric trains enter and 98 leave the terminus. Through services are not run between St. Lazare and Invalides either by the inner circle via Avenue Foch, or by the outer circle via Les Couteaux. Until October last a through service was in force between St. Lazare, Les Couteaux and Issy-Plaine, but since that date only a shuttle service has been in operation between Puteaux and Issy-Plaine.

Compared with the old steam services, the electric stopping trains save 12 min. from St. Lazare to St. Cloud (8·85 miles); 21 min. from St. Lazare to St. Germain (12·9 miles); 19 min. from St. Lazare to Versailles R.D. (14·2 miles); and 25 min. from St. Lazare to St. Nom-la-Breteche (18·4 miles). The busiest hour of the day at St. Lazare is from 18.20 to 19.20, during which period 45 electric trains leave the terminus. The service over the St. Germain line for the one and a half hours between 18.0 and 19.30 is shown in graphical form herewith.

NOTES AND NEWS

Swiss Electrification.—The standard-gauge Gossan-Sulgen and Giubiasco-Locarno lines of the Swiss Federal Railways have been converted to electric traction on the standard 15-kV. single-phase system.

Spanish Line Electrified.—The short State-owned line in the north of Spain from Vittoria to Salinas has been opened to electric traction. Conversion work is proceeding on the ensuing section from Salinas to Mecolalde.

Portsmouth Line.—It is expected that the Southern Railway electrification from Hampton Court junction to Farnham will be opened in January, 1937. The beginning of electric traction over the whole route to Portsmouth is scheduled for the following July. The alternative route from Three Bridges via Arundel should be ready in 1938.

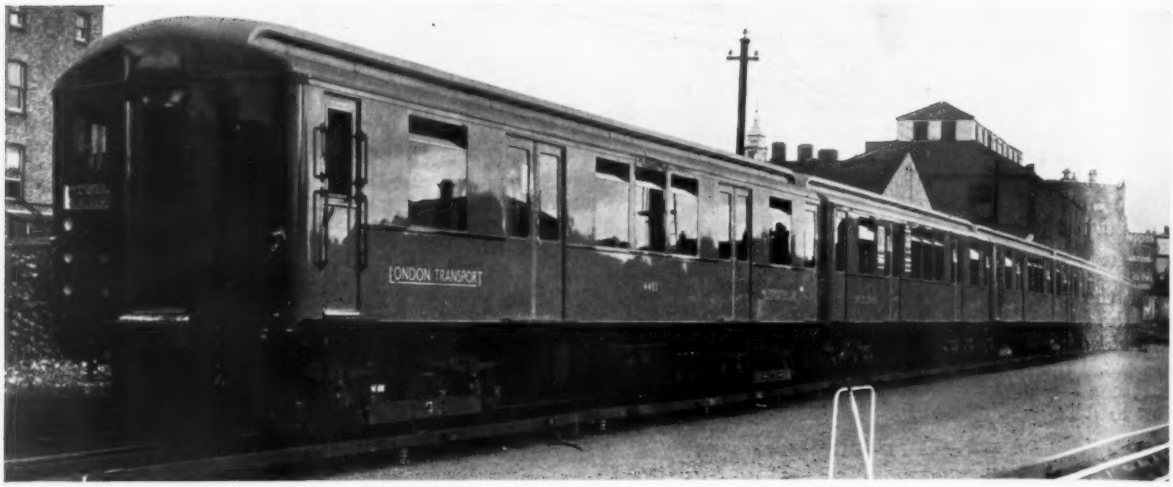
South African Fast Motor-Coaches.—The South African Railways are to purchase two motor-coaches to provide a fast service over the 3,000-volt main lines.

Paris Metro Extensions.—The Metropolitan Committee of the Paris municipality has adopted proposals to construct seven new lines totalling about 10 route miles, and with 19 new stations, at an estimated cost of 612,000,000 fr. These proposals are bound up with schemes for providing employment.

P.O.-Midi Electrification.—Work has now begun on the conversion to the 1,500-volt d.c. system of the Tours-Bordeaux main line. The estimated cost of 400,000,000 fr. is made up of 215,000,000 fr. for overhead equipment and rail bonding; 35,000,000 fr. for transmission lines; 80,000,000 fr. for substations; and 70,000,000 fr. for locomotives and stock.

New four-car streamlined train operating between Osaka and Kobe on the 1,500-volt d.c. lines of the Japanese Government Railways. It runs up to a top speed of 75 m.p.h. on the 3 ft. 6 in. gauge track, and carries about 500 passengers

NEW TRAIN FOR THE LONDON UNDERGROUND



Six-car 1,440 h.p. train for the 600-volt lines of the London Passenger Transport Board

A NEW six-car train embodying certain improved features was placed in service on the lines of the London Passenger Transport Board on July 16, and is now operating on the Hammersmith and City route. Built by the Birmingham Railway Carriage & Wagon Co. Ltd. it comprises three motor-coaches each taring 34·1 tons and three trailers each taring 23·9 tons, the total tare weight of the train being 174 tons. The seating capacity is 42 in each motor-coach and 44 in each trailer, these figures including tip-up seats in the entrance vestibules. The six 240 h.p. motors of this train were built by the General Electric Co. Ltd. and the electric control equipment by the British Thomson-Houston Co. Ltd.

The Alpax doors are worked on a new type of automatic control. They are opened pneumatically from both inside and outside the carriages when passengers press a large push button attached to the doors. This push button is painted red and is provided with an illuminated sign "Push to Open." Immediately the button is pressed by the passenger the doors open to their full width. The object of this system is that only such doors are opened as are required for the needs of passengers, but the doors are opened to their full width and not, as frequently happens with hand-operated doors, part of the width only. The opening is practically instantaneous. The closing is done by the guard from his compartment, and the guard can also open all the doors should he find occasion to do so. The door motors were made by G. D. Peters & Co. Ltd.

The carriages are constructed of steel and have flat sides and windows flush with the sides to facilitate washing and polishing. The seats are of the cushion type, as in the first class carriages of the Inner Circle trains. One-class accommodation only is provided, but all cars are furnished up to the standard of first class on the Circle trains. Electro-pneumatic brakes are used for the first time on the Hammersmith and City line. These secure instantaneous application throughout the train, avoiding the lag of three or four seconds at the rear end which occurs with the older type of brake. There is a new form of ventilator with hinged vane, and an improved form of fixture, in chromium-plated frame and lined with cerulean blue, is fitted for maps and advertisements.

Two views of the new train on the Hammersmith and City Line